

Health Benefits of the Atlanta BeltLine Eastside Trail: A Pre-Impact Assessment

Contract Research
ICOL No. 4876605 (116476)
Final Report

January 31, 2012

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Atlanta BeltLine Partnership. This report does not constitute a standard, specification, or regulation.

“Health Benefits of the Atlanta BeltLine Eastside Trail: A Pre-Impact Assessment” was created by the Georgia Institute of Technology’s Center for Quality Growth and Regional Development (CQGRD).

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1. Introduction

1.1 History of the Atlanta BeltLine project

The Atlanta BeltLine project is one of the largest redevelopment projects currently underway in the United States. It represents an exciting new vision for the city of Atlanta and the Atlanta region. This vision shows a true commitment to the future success of the city through the transformation of a 22-mile mostly abandoned loop of freight rail easement land to a new system of parks, trails, and transit. The positive economic impact of the project has already been demonstrated as the initial planning for the BeltLine has sparked new residential and commercial development along the corridor. The BeltLine is moving Atlanta forward in achieving the goal of a high quality of life for residents at a scale and scope not seen before in Atlanta by creating greenspace, walkable neighborhoods, high-quality infill development, transit, and healthy communities.

The entire BeltLine loop lies between two and four miles from the city center, encircles the City's core, and will affect approximately 45 neighborhoods, touching all council districts in the City of Atlanta. This major project will also result in improvements to 700 acres of existing parks as well as creating 1,300 acres of new greenspace and parks. The plans for the project also include 33 miles of new multi-use trails connecting 40 parks and a 22-mile loop of rail transit service, with an anticipated daily ridership of over 73,000. It is projected that the 6,545 acres of redevelopment (approximately seven percent of the city's land area) will create over 29,000 housing units, of which approximately 5,600 units will be set aside for lower-income individuals and families; 30,000 new jobs; and almost 12 million square feet of new construction, to include 5.3 million square feet of office space, over 1.3 million square feet of retail space; 5.2 million square feet of industrial; and 407,000 square feet of public or private institutional space. In addition, there will be sidewalk, streetscape, road, and intersection improvements planned throughout the BeltLine area to link the parks, trails, transit, and redevelopment of the BeltLine to existing neighborhoods. Taken together, the BeltLine components are intended to create a continuous loop of urban regeneration around the core of the city. Linked by transit and greenspace, the BeltLine will connect people with places and with each other.

Construction is underway on a 2.5 mile section of the BeltLine located in northeast Atlanta. This section extends from Piedmont Park to DeKalb Avenue and is one of the first sections to be developed as a multi-use trail. This section of the BeltLine, known as the Eastside Trail, will include lighting, plantings, and other design elements and is intended for walking, bicycling, and other non-motorized movement.



Figure 1: Rendering of potential design for the Eastside Trail (www.beltline.org)

Work on this trail segment began on October 30, 2010 and is scheduled to be completed in May of 2012. Figure 2 shows the overall 22-mile route of the BeltLine and highlights this section, which was the focus of the research. Figure 3 shows details of the Eastside Trail corridor including adjacent roads and parks as well as the boundaries of the study area located adjacent to the trail.

This report documents the existing conditions in the study area and measures the existing behavior of the population in the study area. This data compiled in this report will provide the basis for future study to determine how behavior changes once the trail is constructed. This will enable the research team to measure the potential health benefits associated with the construction of the Eastside Trail. The research will specifically determine whether the trail design, implementation, and associated activities increase physical activity for the surrounding population, improve access to destinations, and provide an increased opportunity for active modes of travel.

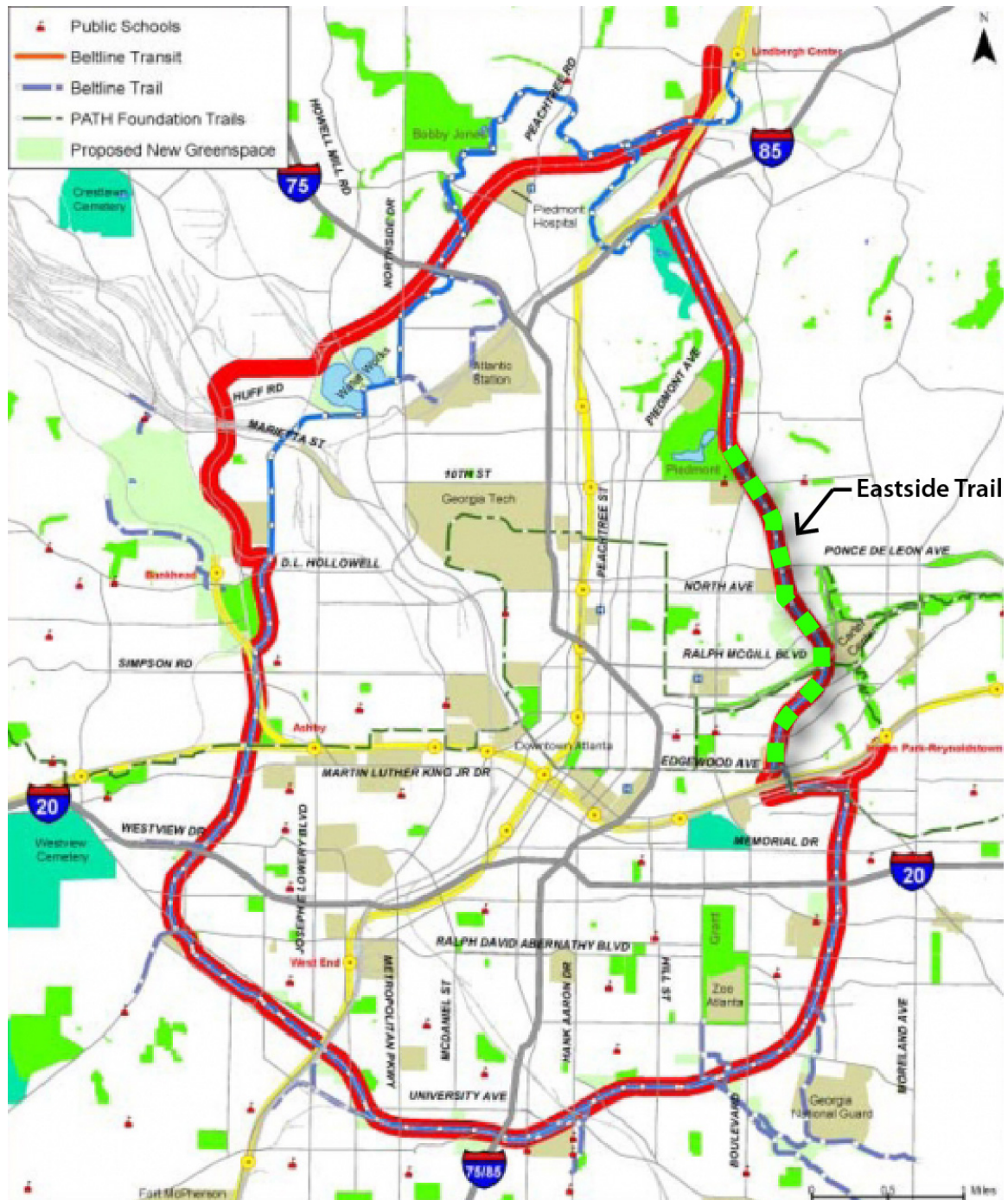


Figure 2: Overview of the Atlanta BeltLine. The Eastside Trail portion is highlighted in green. (www.beltline.org)

Atlanta BeltLine Eastside Trail

Existing Conditions

- Existing Parks
- Major Roads
- Minor Roads
- Eastside Trail
- Atlanta BeltLine

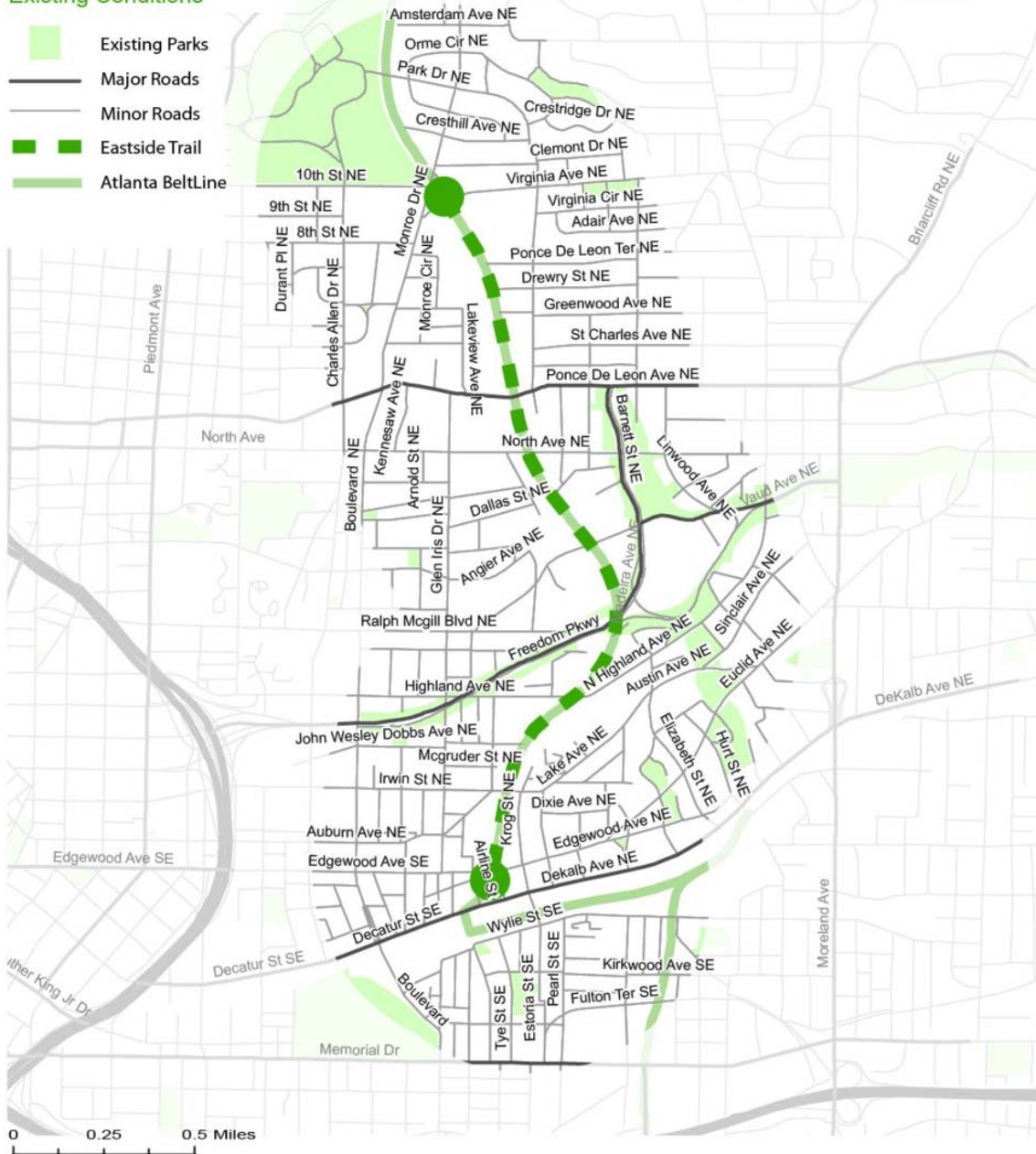


Figure 3: Details of the Atlanta BeltLine Eastside Trail

1.2 Health and the Built Environment

The World Health Organization defines health as “a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity.” The 1986 Ottawa Charter

for Health Promotion expands this definition to include the ability of an individual or group “to identify and to realize aspirations, to satisfy needs, and to change or cope with the environment.” These definitions recognize that numerous factors influence the ability of an individual to be healthy. Known as health determinants, these factors include biological, social and economic, environmental, lifestyle, services, and policy. These definitions also clearly allow for the expansion of the idea of public health to include the impact of conditions beyond the behavior of the individual. Thus, many external factors—the environment where one lives, works, and goes to school; and the social and economic factors, policies, and services that shape the environment—affect an individual’s ability to be healthy.

The built environment is comprised of the manmade surroundings that provide the setting for human activity. It is determined by land use and settlement patterns, transportation systems, avoidance of environmentally sensitive areas, and urban design. Land use patterns establish the proximity of different activity centers and spatially determine where various activities occur, including residential areas, commercial areas, community facilities, and areas preserved as open space, among others. Transportation systems connect the activities that have been organized resulting in existing land use patterns; the structure of the transportation system both enables and constrains the options available to individuals for travel between daily activities and destinations. Urban design policies influence the details of development patterns impacting buildings, open space, and transportation systems. Design determines how far a building is from the street, the width of a sidewalk, and the placement of street trees and benches. Design policy dictates the character of the buildings and sets the overall aesthetic qualities of the constructed environment.

In recent years research has suggested a linkage between the characteristics of the built environment and human health outcomes, such as respiratory and cardiovascular health, fatal and non-fatal injuries, physical fitness, obesity, mental health, and social capital. Although causality is not conclusively proven, there is sufficient evidence linking elements of the built environment and health to warrant inclusion of health considerations in project and policy decisions. As such, there is reason to believe that the BeltLine Eastside Trail, which will directly

affect households, business, schools, and other community facilities along the 2.5 mile corridor, will play a role in the future health of those who live, work, play, and go to school near it.

This research studies how an external health determinant such as the construction of the BeltLine Eastside Trail can potentially shape individual behavior patterns in the population by providing new non-motorized multi-use infrastructure. The research also analyzes how this behavioral change can impact public health, specifically by providing an increased opportunity for physical activity as well as how the creation of greenspace, which provides opportunities for social interaction, can improve mental health. Positive physical health and positive mental health are closely correlated and both are critical to the overall health of the population.

The research conducted for this study provides evidence to determine whether the BeltLine Eastside Trail and other similar projects can encourage healthy behaviors by providing people with the infrastructure, access to destinations through effective adjacent land use designations, and urban design details to encourage walking, biking, and transit as viable transportation options; by providing parks and trails for physical activity and social interaction; and by locating jobs and services, such as grocery stores and health care centers, closer to where people live. Furthermore, the lessons learned in the development of the BeltLine Eastside Trail informs new development and redevelopment throughout the city and region. A review of the findings of the literature analyzing the relationship between the built environment and health is summarized in this report as a framework to understand how interventions in the built environment such as the BeltLine Eastside Trail can impact behavior.

1.3 Research Objectives and Methodologies

The construction of the Atlanta BeltLine Eastside Trail offers a unique opportunity to measure the effects of the construction of an urban multi-use trail that extends through existing residential neighborhoods. The surrounding land uses include both single-family and multi-family residential households as well as commercial and retail establishments, parks, and schools. The trail will provide new opportunities for active modes of travel between these origins and destinations by creating direct connections between locations which are currently not easily accessed except through the use of an automobile.

The objective of the research is to measure the impact of the Atlanta BeltLine Eastside trail on the physical activity, mental health, behavior, and characteristics of the population located along the Eastside Trail section of the Atlanta BeltLine. This report includes the documentation of the existing behavior of the population prior to the completion of the trail, as well as an inventory of other existing physical and socio-economic conditions existing prior to trail construction.

The various populations targeted for the research included those that are most affected by the construction of the Eastside Trail. This includes: individuals living along the BeltLine corridor, those individuals using the existing temporary BeltLine trail, individuals observed on major transportation intersection access points along the trail (such as road crossings) and individuals observed in existing parks along the corridor. The instruments used to gather this information included in-person surveys, pedestrian and bicycle observations and in-person counts by researchers, and an on-line survey. The specific methodology for this study included the use of questionnaires to collect information from potential trail users regarding baseline travel behavior, physical activity levels, access to transit and destinations, and other health-related quality of life variables. This research was conducted in compliance with the policies established by and with the approval of Georgia Institute of Technology's Institute Review Board (IRB) to ensure the protection of human subjects.

A demographic study of the land use and households located in the BeltLine Eastside trail corridor was also conducted. The study area corridor was defined as those parcels located within a 0.5 mile buffer on either side of the trail. This information was used to determine if the individuals observed and interviewed using the temporary trail reflect the demographics of the surrounding population. The distance of 0.5 miles from the trail for the study area corridor was selected as a reasonable distance that individuals would be likely to walk to reach the trail facility.

The research methodology also includes a literature review to establish the relationship between the built environment and health as well as to review previous research conducted on urban trail interventions which analyzed corresponding effects on behavior. Another key objective of the literature review was to conduct a comprehensive review of the historical and practical foundation of trail design and current trail design practices and to assess the built environment

factors impacting trail usage, access, and safety, and correlations with physical activity and other health benefits. This information and analysis will be used to provide guidance to the Atlanta BeltLine Partnership. A secondary focus of the research is to document the benefits of these types of urban interventions in terms of the positive health benefits incurred by the surrounding population. Examples of similar trail projects and best practices from around the country were reviewed and are described in the report. These best practices were then used to inform the design of the research methodology for the analysis of the BeltLine Eastside Trail and offer guidance for the practical implementation recommendations section of the report.

1.4 Report Organization

The report is organized as follows. Section 2 provides a review of the literature which illustrates the benefits of physical activity related to improving public health and disease prevention. This section also describes the findings of the existing research which establishes the relationship between public health and the built environment. Specifically the effects of urban trails, such as the BeltLine Eastside Trail, related to these issues are described. Section 2 also includes current research on the health statistics of demographic groups that are of higher risk for certain health conditions due to socio-economic status. These vulnerable population groups often are more likely to suffer from negative health impacts. The research indicates that the study area includes four census tracts with populations that could be characterized as vulnerable, as the term is defined in this report.

Section 3 defines the study area corridor and describes both the existing physical conditions found in the corridor and the existing socio-demographic characteristics of the corridor. Section 4 includes the details of the methodology used for the data collection procedures, the subject populations included in the study, and the result of the analyses. Section 5 describes the calculated latent demand for the study corridor. The demand is established by first identifying the characteristics of the existing transportation infrastructure, barriers to access, and finally forecasting potential demand for walking and bicycling travel options based on the existing land use in the study area. Section 6 draws conclusions from the body of literature and synthesizes

the results of the surveys and the opportunities and challenges presented by the existing conditions. This data then is utilized to formulate recommendations.

2. Health and the BeltLine Eastside Trail

2.1 Physical Activity and Health

One aspect of overall health is physical health, which can be defined as fitness level, the presence or absence of disease or disease risk factors, the utility of body systems, and the body's exposure to abuses, such as stress, addictions, or radiation (Eberst, 1984). Historically, physical health had been equated with overall health, though it is now recognized that there are a variety of dimensions included in overall well-being. Physical activity, the main contributor to an individual's fitness level, is an important component of the individual's physical health, as well as public health in general. Unfortunately, an increasing lack of physical activity is becoming a global trend.

Physical inactivity and elevated body mass index (BMI) are among the most pressing health concerns today. Thirty-four percent of Americans are obese, and more than two-thirds are overweight or obese. Obesity, defined as a BMI over 30, leads to elevated risk for heart disease, type 2 diabetes, cancer (including breast cancer and colon cancer), high blood pressure, stroke, liver disease, sleep disorders, arthritis, and infertility. Obese individuals are twice as likely to die prematurely as their non-obese counterparts. Sixteen percent of American children are obese, many of them already at risk for heart disease and type 2 diabetes (National Center for Chronic Disease Prevention, 2009). Physical inactivity is a primary factor in obesity, and it is thought to contribute to approximately 30 percent of all U.S. deaths. Physical inactivity is estimated to have cost the United States more than \$250 billion in 2006 (Chenoweth & Leutzinger, 2006).

According to the U.S. Department of Health and Human Services (DHHS), adults should get at least 30 minutes of moderate physical activity five times a week, and children should get at least 60 minutes of activity daily (Ewing & Kreutzer, 2006). Fifty-four percent of Atlanta Metropolitan residents do not meet the recommended guidelines for daily amounts of physical activity, and lack of physical activity contributes to the three leading causes of death in the

metropolitan region, according to the National Center for Chronic Disease Prevention and Health Promotion 2008.

Physical Activity and Chronic Diseases

Physical activity can be defined as “bodily movement produced by the contraction of skeletal muscles that increases energy expenditure above the basal level” (U.S. Department of Health and Human Services, 2001). It is typically categorized by the context in which it occurs, such as transportation, leisure, household, and occupation (Humphrey, 2005). As the rate of physical activity in the United States has been declining, the rates for certain types of disease have simultaneously been increasing; obesity rates and BMI measures across the population in the United States have also been rising (Lopez, 2004). For these reasons, chronic disease has replaced infectious disease as the leading cause of death in all populations. Obesity and overweight leads to 2.8 million deaths annually, while physical inactivity separately contributes to 3.2 million deaths annually (World Health Organization, 2009). Whereas infectious disease results from contact with viruses and bacteria, chronic disease is largely, although not exclusively, an issue of lifestyle, environment and long-term exposure. Among other behavioral and environmental conditions, physical inactivity is considered to be a major risk factor for contracting non-communicable (chronic) disease (WHO, 2011). This lack of exercise can be linked to a higher risk of cardiovascular disease, stroke, diabetes, cancer and depression (WHO, 2010). Specifically, physical inactivity is a contributing factor in 21.5% of ischemic heart disease, 11% ischemic stroke, 14% diabetes, 16% of colon cancer and 10% of breast cancer (Bull et al., 2004; as cited in de Nazelle et al., 2011). The literature demonstrates robust evidence that physical activity is associated with positive health outcomes.

Regular physical activity is also beneficial to people of all ages and walks of life, having positive effects on health, longevity, and quality of life. It has been found to improve self-image, self-esteem, physical and mental wellness, and overall health. The benefits of regular physical activity extend to both older and younger adults (Kaplan, 1996; Paffenbarger, Hyde, Wing, Lee, et al., 1993; Sherman, D’Agostino, Cobb & Kammel, 1994; Humphrey, 2005). In fact, benefits of physical activity have been seen in all segments of the population including people with

disabilities and chronic diseases (Humphrey, 2005). Participating in regular physical activity starting at an early age appears to have lifelong health benefits in terms of early muscle, bone, and joint development as well as weight control, high blood pressure prevention, and feelings of depression and anxiety (Report to the President, 2000; Humphrey, 2005).

2.2 Built Environment and Health

In response to these negative health statistics, increased focus on external changes to behavior have become the subject of study, such as the link between health and the built environment. Policies and programs that discourage the population from using active transportation modes to accomplish utilitarian trips has resulted in an increasing reliance on the exclusive use of individual automobiles for all trips, and in missed opportunities to incorporate exercise as part of daily life. However, creating a built environment that is supportive of physical activity through infrastructure availability as well as land use policy that connects households and destinations can encourage physical activity and potentially reduce some of these negative health conditions (Ross & Marcus, 2008). There is also evidence to suggest that individuals can accumulate health benefits through exercise that is at least 10 minutes in duration. Thus, time spend traveling on foot (for at least 10 minutes) can increase physical health (Ewing & Kreutzer, 2006).

Research has also shown that walking at least ten blocks per day is adequate to maintain health and reduce the risk of cardiovascular events in older individuals (Sesso, Paffenbarger, Ha & Lee, 1999). Studies have shown that walking has positive effects on the accumulation of physical activity and therefore has positive effects on health. Frank et al. (2006) found that a 5 percent increase in walkability was associated with a 32.1 percent increase in time spent engaging in physically active travel, a 0.23 point reduction in BMI, and 6.5 percent fewer vehicle miles traveled in King County, WA. Saelens, Sallis, Black and Chen (2003) found that people who live in walkable neighborhoods averaged an additional 30 minutes of walking for transportation each week and achieved more total physical activity. Walking has also been shown to be the most accessible method of incorporating physical activity into daily activities. It is the easiest and most common type of daily physical activity and is available to the most number of people.

Walking is confirmed to be a preferred form of physical activity by an overwhelming majority of study populations across different gender, age, and income groups. (Lee & Moudon, 2004). Four studies (Ball, Bauman, Leslie & Owen, 2001; Booth, Bauman, Owen & Gore, 1997; Giles-Corti & Donovan, 2002; Troped, Saunders, Reininger, Ureda & Thompson, 2001) report walking as the most frequently engaged physical activity. These findings suggest that even small changes in the amount of pedestrian or bicycling activity in a community may decrease incidents of disease.

Travel Mode Choices

Prior to the focus on the built environment within public health research, transportation planning researchers have examined associations between the built environment and travel behavior. This body of research suggests growing automobile dependence due to the characteristics of the built environment may have considerable implications for physical activity and health.

A 2004 study of Atlanta, Georgia, found that each additional hour spent in the car was associated with a 6 percent increase in the likelihood of becoming obese and every kilometer walked per day was associated with a 4.8 percent reduction in the likelihood of becoming obese (Frank, Andresen & Schmid, 2004). However, Bodea, Garrow, Meyer & Ross (2007) conducted a second study in Atlanta which reviewed the results of the first study. Bodea et al. found in this second study that while built environment characteristics remained significant, the inclusion of socio-demographic variables in the research design reduced the effect of built environment on the occurrence of obesity (2009).

An increase in the amount of daily physical activity could be achieved through the use of active transport for routine activities. Both walking and cycling can be done for multiple purposes including leisure, recreation, or exercise; for occupational purposes; and for basic transportation, including shopping or going to work (Sallis, Frank, Saelens & Kraft, 2004). *Active* (or non-motorized) *transportation* is a form of physical activity, and evidence suggests that the use of active transportation is related to transportation and land-use policy. A built environment that encourages integrating active transportation with other daily activities such as work, commuting

and child care, may contribute to increased walking and cycling (Booth, Bauman, Owen & Gore, 1997).

Studies which explored mode choice between motorized and non-motorized methods of transport showed that 40% of respondents considered the lack or poor condition of pedestrian and cycling routes as limiting their walking and cycling to work, and about 30% considered these activities as unsafe modes of transportation. Fear of accidents limited physically active commuting in 30% of all women and in 14% of all men. (Oja, Vuori & Paronen 1998) In a recent study of mode choice and street network characteristics in 24 California cities, density, street connectivity, and grid network were significantly associated with increased bike, walking and transit (Marshall & Garrick, 2010).

Health Changes Associated with Behavioral Shift to Active Travel Modes

Studies suggest that mode shifts to active transportation (walking and cycling) generate positive health outcomes through increased physical activity (Woodcock et al., 2009; de Hartog, Boogaard, Nijland & Hoek, 2010). A study in Copenhagen, Denmark found that bicycling to work (average cycling time to work was three hours per week) was associated with a 38 percent decreased risk of mortality after adjusting for leisure-time physical activity, body mass index (BMI), blood lipid levels, smoking, and blood pressure (Andersen, Schnorr, Schroll & Hein, 2000). Another study examined men between the ages of 50 and 59 and found that those who regularly spent more than 10 MET h/week (metabolic equivalent hours per week) in walking or cycling to work had a lower mean BMI (0.3kg/m^2), waist circumference (1 cm) and change in BMI over 5 years (0.06 kg/m^2) than those who did not expend energy getting to work (Wagner et al. 2001).

A review of evidence linking active commuting and cardiovascular disease demonstrated the protective effect of active commuting, as active commuting was associated with an overall 11% reduction in cardiovascular risk (Hamer & Chida 2008). In a study evaluating the effects of a work travel plan on reported commuting patterns, the number of respondents walking to work increased from 19% in 1998 to 30% in 2007. The majority of “usual” walkers and cyclists were estimated meet greater than 80% of recommended physical activity levels, demonstrating possible health improvements associated with changing commuting patterns (Brockman & Fox,

2011). Some studies have found that active commuting (walking or cycling for transportation) is an effective method of achieving desired activity levels (USDHHS, 2008; Matthews et al., 2007; Andersen, Schnor, Schroll & Hein, 2000) and therefore even modest increases in physical activity have the potential to produce significant health benefits (Haskell, Lee, Pate, Powell, et al., 2007).

Role of Transit

A survey of the literature indicates that taking transit is linked to increased physical activity. Besser and Dannenberg (2005) found that Americans who use transit average 19 minutes of daily walking going to and from transit. Thus increasing access to transit could significantly increase the opportunities to be physically active, as most transit trips incorporate walking to and/or from destinations. The study also found that 29 percent of people walking to and from transit achieve the recommended level of 30 minutes of daily physical activity. In addition, the results of the study indicated that rail users (more so than bus users), minorities, households earning less than \$15,000 per year, and people in high-density urban areas were most likely to achieve recommended physical activity levels by walking to transit. These groups are also the most likely to suffer from obesity and overweight. Finally, the study found that 72 percent of single-segment walking trips are less than 10 minutes in duration which is under the Surgeon General's recommendation of accumulating physical activity in periods of 10 minutes or more. However, it was unclear from research whether or not accumulating these shorter periods of activity also has a positive health benefit (Besser & Dannenberg, 2005).

The ability and likelihood of an individual walking to a transit station have been found to be affected by distance to station, density, number of parking spaces, grid pattern, physical quality of the environment, facility conditions, time, cost, and individual level factors, i.e. gender, ethnicity, age, income, and education (Loutzenheiser, 1997). Recent research in New York found that adding a commuter rail stop not only resulted in new riders who previously drove, but meaningful increases in the level of physical activity of existing commuters. Respondents reported increased total weekly activity levels, in many cases enough to move them from the "insufficient" to "meeting recommendations" categories of physical activity (Greenberg & Renne, 2005).

The studies' findings imply that, to enhance the health and well-being of the population, infrastructure for walking and biking needs to become an integral part of public transportation systems and services. Highly connected, mixed-use development should be actively pursued to entice increases in walking and biking for transportation (Rutherford, Ishimaru, Change & McCormack, 1995; Hess, Moudon, Snyder & Stanilov, 1999; Moudon & Hess, 2000).

Creating Opportunities for Physical Activity

Reviewing the existing transportation literature, several studies have presented frameworks for attributes of neighborhoods and the built environment that encourage active commuting and physical activity. Greater land-use mixes, population and employment density, street connectivity and continuity of the bike and pedestrian network, are all believed to increase physical activity and contribute to positive health outcomes, as are the presence of recreational facilities and parks (Ewing & Kreutzer, 2006). Khisty proposed seven factors to reduce barriers to walking: increased attractiveness, comfort, convenience, population density, mixed land use, safety, system coherence, and continuity (Craig, Brownson, Cragg & Dunn 2002, Khisty 1994).

Design Elements that Encourage Health

Many studies have examined the role of built environment characteristics in mode choice and associated public health outcomes related to physical activity. The layout of cities and communities and their transportation infrastructure are important factors in determining whether people walk or drive as a means of transportation (Moudon, Hess, Snyder & Stanilov, 1997; Frank & Engelke 2001). Transportation mode choices related to active transportation reflects two fundamental aspects of land use: proximity, as determined by density of land uses and land use mix; and connectivity which is the ease of movement between origins and destinations within the existing street and sidewalk – pathway structure. Connectivity is also increased with the absence of barriers to walking or cycling, and multiple route options increase the viability of walking or cycling as a mode choice (Saelens, Sallis, Black & Chen, 2003). Studies repeatedly demonstrate that mixed land use diversity is the urban design variable most likely to affect the walkability of neighborhoods, primarily by influencing the accessibility and convenience of locations (Saelens, Sallis, Black & Chen, 2003, Giles-Corti & Donovan 2002, Handy & Clifton, 2001).

Greater density is also associated with increased transit use, walking and less driving (Ewing & Cervero, 2010, Marshall, 2008). According to a study on walkability and transit-oriented development, density and connectivity encourage transit use and may increase the distance pedestrians are willing to walk to access transit services (Canepa, 2007). One study also found that children living in neighborhoods built after 1969 were more likely to be obese than children living in pre-1969 neighborhoods, which may be associated with changes in land use patterns and built environment design (Spence, Cutumisu, Edwards & Evans, 2008). Pikora et al (2003) developed a framework that identifies four features of neighborhoods that are likely to be associated with people's walking and cycling: functional, safety, aesthetics and destinations. Research on the characteristics of walking behavior has shown that walking for recreation was associated with functional features of local environments whereas walking for transport was associated with destinations (Pikora et al., 2006).

Street features such as on-street parking, bike lanes, and sidewalks are associated with less driving (Marshall & Garrick, 2010). Intersection density was “almost always” associated with walking and cycling, while street pattern and land-use mix were highly associated with increased mode share of walking and cycling. There is strong evidence for infrastructure changes and promotional campaigns potentially effecting behavioral changes towards active transportation (Ogilvie, Egan, Hamilton & Petticrew, 2004; Pucher, Dill & Handy, 2010; WHO-UNECE, 2009). In addition, a study of pedestrian path choice suggested an association between a “good” pedestrian environment and the utility of walking and that the effect would justify policy intervention to alter the built environment to encourage walking (Guo, 2009).

Criticism

However, not all studies have demonstrated a clear association between built environment characteristics and mode choices or physical activity outcomes. For example, studies of adult populations in Australia and Washington State found that built environment characteristics was not associated with BMI and did not find built environment characteristics predictive of walking for exercise (Christian, Giles-Corti, Knuiman, Timperio & Foster, 2011, Lovasi et al., 2008).

A recent report by the Transportation Research Board/Institute of Medicine on physical activity and the built environment recognized that several factors such as land-use mix, accessibility, and transportation infrastructure had good support, although both panels concluded that the data were insufficient to determine how the built environment affects physical activity across population subgroups (Humphrey, 2005; CDC, 2006). The Task Force concluded that street-scale and community-scale design interventions were effective at increasing walking and cycling (CDC, 2006). The current discrepancies between research results in this area likely reflects differences in research design, specific built environment characteristics studied, and the difficulties in establishing causality or separating effects of different variables (Humphrey, 2005).

Crime/Safety and Physical Activity

The rate of intentional injuries – those due to crime and violence – is influenced by the built environment. These injuries occur at lower rates, in communities with more trees, where neighbors are acquainted, where citizens informally patrol the street from windows and sidewalks, and individuals have access to public transit. (Goodell & Williams, 2007). Tract-level studies have demonstrated disparities between indicators of physical and social disorder as well as health disparities between neighborhoods. Disadvantaged neighborhoods are often marked by concentrated poverty, low rates of homeownership and college education, and single-parent households. Neighborhood disadvantage and disorder can contribute to low health status by inhibiting physical activity via walking, and cause stress, which may increase vulnerability to infection and disease.

Social “disamenities” such as crime rates may also impact the uses of neighborhood physical activity sites. Addressing the paradox of higher obesity rates among black and Hispanic residents given greater park access in New York City, a study examined the prevalence of neighborhood “disamenities” and proximity to parks (Weiss et al., 2011). The study found that black and Hispanic residents have greater access to parks but are also exposed to greater “disamenities,” such as undesirable land uses, crime (measured by homicide rate), and traffic hazards. This study echoes a larger literature on the existence of crime and crime perception as a

major deterrent to physical activity and health promotion (Foster & Giles-Corti, 2008; Harrison, Gemmel & Heller, 2007).

Mental Health

Another dimension of overall health and well-being is mental health. According to the 1999 Surgeon General's report, "*mental health* is a state of successful performance of mental function, resulting in productive activities, fulfilling relationships with other people, and the ability to adapt to change and to cope with adversity" (Satcher, 1999). The World Health Organization has defined mental health as a "state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community" (WHO, 2004). In both of these definitions, mental health is not only the absence of mental illness, but the presence of a positive mental state (Keyes, 2007). Since regular physical activity reduces depression, improves mood, and enhances cognitive functioning (U.S. Department of Health and Human Services, 1996; World Health Organization, 2000); a potential increase in physical activity through trail construction holds potential for mental health benefits. Participating in regular physical activity starting at an early age appears to have lifelong health benefits in terms of preventing feelings of depression and anxiety (Report to the President, 2000; TRB, 2005).

Since mental health is closely associated with a healthy population, one method to describe and measure the mental health of the population is to measure the degree of social capital that exists in the population. Social capital has been linked to a variety of health outcomes, such as prolonged life expectancy and improved physical condition and mental health (Leyden, 2003). Social capital can be defined as the collective value of a network—social, political, and economic—whose purpose is to inspire trust in and provide support for other members of that community (Dannenberg et al., 2003). Social capital is the degree to which people feel that they live in and belong to a socially cohesive local environment, and the range of activities and resources that emerge as a consequence of those ties. Social capital is built both formally, through participation in group activities, and informally, through casual association and encounters.

A study of three neighborhoods in Washington, DC explored the linkages between the presence and capacity of local institutions and several indicators of social capital. Roman & Moore (2004) found that the quantity of religious institutions and pro-social places (i.e. parks, schools, recreation centers) were correlated with trust, community participation and block satisfaction. In addition, the study found that the distance or accessibility to these institutions was associated with higher levels of social capital indicators (Roman & Moore 2004). A study of religious effects on community participation found that among the sample of church-going Protestants, church participation was the strongest predictor of all types of formal volunteering (Park & Smith, 2002). These studies indicate the importance of local, community institutions for the creation of social, healthy places.

The linkages between institution accessibility and community participation indicate the importance of the built environment for social capital. Research suggests that walkability, automobile dependence, mix of land uses, density, size of place, traffic volume, homogeneity, and presence of public spaces all impact social capital through their ability to create or support opportunities for formal and informal interaction. Built environments that promote social interaction can produce mutually reinforcing effects on place attachment or “sense of place” and social capital (Wood and Giles-Corti, 2008; Waxman, 2003).

Automobile dependence, in particular for commuting long distances, has been correlated with decreased social capital (Ewing & Kreutzer, 2006). Robert Putnam found that each 10 minutes spent commuting translates directly into a 10 percent decrease in community involvement (Putnam, 2000). Traffic volume has been shown to affect people’s sense of community; as traffic volumes increase, people’s social capital decreases. In a study by Besser et al (2008), social capital was operationalized as travel purpose (socially-oriented trips). The study suggests that for every additional 10-minute increment in the categorical commute time variable, there is a corresponding increase in risk of no socially-oriented trips (increase in commute time negatively correlated with social capital). Similarly, research suggests that people residing on streets with light traffic volumes have larger social networks than those on streets with heavy volume (Lavin et al., 2006). The link between high traffic volume/speed and low social capital

stems primarily from three causes: fear for personal safety, which limits walking and children playing outside; not wanting to walk in an unpleasant environment; the physical divide caused by the amount of traffic, its speed, and the width of the road (Lavin et al., 2006)

Several studies demonstrate the linkages between land-use mixing, access to amenities and social capital. In a study of physical activity, social capital and the built environment, social capital was associated with access to services (restaurants, bars, libraries and museums) and associated with lower pedestrian injury rates. However, social capital indicators were negatively associated with land use mixing and access to parks and transit (Wen & Zhang 2009). A study of Australian suburban neighborhoods found that the number and quality of destinations was associated with social capital (Wood et al., 2008), while a study in Portland, Oregon (Lund 2003) found that local retail access was positively associated with social capital indicators in inner-city (but not suburban) neighborhoods.

The decline of social capital has been attributed in part to a loss of public spaces. These public spaces, including sidewalks, parks, plazas, dog parks, community gardens, playgrounds, and even cafes, bookstores, and hair salons provide spaces in which people can interact intentionally or accidentally, formally or informally. These moments of interaction, whether for the exchange of pleasantries or information, create and strengthen the social networking bonds of social capital and can have real and substantial positive health outcomes (Ewing & Kreutzer, 2006; Baum & Palmer, 2002; Bedimo-Rung, Mowen & Cohen, 2005; Leyden, 2003). In a study of parks, physical activity and social capital in New Orleans, parks with higher social capital were found to have more park users and more than four times the amount of physical activity than parks with lower social capital (Broyles, Mown, Theall, Gustat & Rung, 2011).

In addition, these opportunities for socializing in public spaces or neutral territories can help reduce feelings of prejudice and increase understanding of other cultures and races by enabling interaction amongst people of differing races, economic status, education levels, and ethnicities thereby building feelings of social capital (Lewis, 1996). Homogeneity in communities, particularly in terms of income and age, has been shown to reduce social capital, in particular

political participation, which can have detrimental impacts on the well-being of that community (Ewing & Kreutzer, 2006).

Examining recent literature, substantial linkages exist between indicators of social capital and a variety of associative variables relevant for urban design and health promotion. As numerous studies suggest, access to services and public spaces, pedestrian amenities and local institutions can affect residents' social capital and potentially affect selected health outcomes such as physical activity levels and described health status. However, social capital research is in its early stages, and further research is necessary to examine the effects of self-selection bias and establish causality among the associative variables determined to affect social capital.

Greenspace

The presence of greenery has been linked to lower crime rates and better mental health, air quality improvement, and micro-climate improvement. Green streets are designed to improve stormwater retention, enhance aesthetics, and reduce impervious surfaces through the careful use of materials and landscaping. The presence of a thriving natural environment can also boost property values.

One study by Bodin and Hartig (2003) found that running in a park fostered more psychological restoration than running in an urban environment. Walking in a natural setting has also been shown to alleviate symptoms of mental fatigue more than walking in an urban environment (Hartig, Mang & Evans, 1991). Similar results have also been reported in the classroom and workplace. Attentional capacity was measured in university students with differing views from dormitory windows ranging from a lake and trees to streets and buildings. Those with the natural views performed better on attentional measures than did those with views of buildings (Tennessen & Cimprich, 1995). Having natural views of trees and flowers in the workplace is related to lower levels of perceived job stress and higher levels of job satisfaction as well as fewer illnesses at work, such as headaches (Kaplan & Kaplan, 1989). A ten-year study of patients recovering from surgery showed that patients with a view of trees had shorter hospitalizations (8.0 days compared 8.7), needed less pain medication, and had fewer negative comments in nurses' notes than did patients with window views of a brick wall (Ulrich, 1984).

Greenspace has also been linked to mortality in elderly individuals. Five-year survival rates for senior citizens improved when there was space for taking a stroll or parks and tree lined streets near their home (Takano, Watanabe & Nakamura, 2002). Having natural environments nearby has been shown to enhance children's psychological health. Wells and Evans (2003) suggest that the presence of nearby nature in the window view and in the surrounding outdoor yard buffers the impact of life stress on rural children and enhances self-worth. The attenuation of attention deficit disorder (ADD) and attention deficit hyperactivity disorder (ADHD) symptoms has also been shown after contact with nature. In one study, parents were asked to rate after effects of several green outdoor and indoor activities (e.g. reading) for children with physician-diagnosed ADHD. Ratings showed that green outdoor activities reduced symptoms significantly more than built outdoor or indoor activities after controlling for activity type (Kuo & Taylor, 2004).

Trails and Health

Like parks, trails are also important places where physical activity occurs. In a national U.S. sample, people responded that they engaged in physical activity on walking/jogging trails 24.8 percent of the time (Brownson, Baker et al. 2001). The literature also indicates a relationship between parks and trails and meeting the CDC/ACSM recommendations for physical activity. A study by Huston, Evenson, et al. (2003) and colleagues found that trails were associated with a 51 percent increased chance of meeting the CDC/ACSM recommendations for physical activity, controlling for individual level factors. In addition, Brownson (1999) found a 55 percent increased chance of individuals meeting the recommendations if people had access to a walking/biking trail after controlling for demographic variables.

Trail use is often related to trail accessibility and other aspects such as connectivity, continuity, length of routes, presence of bike lanes, and signage. Connectivity of bikeways is an important factor that influences their use. In Eugene, Oregon bike trip volume increased 76 percent where bikeways were connected. Each mile of bikeway across 18 US cities was associated with a .075 increase in commuters using bikes (Nelson and Allen, 1997). Additional evidence of the link between access to trails and increased use comes from the transportation literature. The Federal Highway Administration (FHWA, 1994) reported that cities with higher

levels of bicycle commuting had 70 percent more bikeways per roadway mile, six times more bike lanes per arterial mile, and tended to be laid out in grids. In addition to the determinants of use based on the design of the built environment, presence of trails, and issues of access, there are determinants of use based upon the individual user. In Arlington, MA, Troped, Saunders, et al. (2001) found that higher education and living in a mixed residential or commercial neighborhood were related to increased use of a local bike path. In addition, older individuals and women were less likely to use the bikeway. Another study in rural Missouri found that after walking paths were introduced 55.2 percent of trail users increased the time they spent walking (Brownson, Housemann et al., 2000; Brownson, Baker et al., 2004). Many people who were not previously walking for exercise reported they were now doing so and that others who were already active increased their amount of activity because of the trail. Interestingly, the study also found that groups which are often considered 'hard to reach' were using the trails: women and individuals with less than a high school education increased their walking the most. In addition to regular walkers, women, people earning more than \$35,000 per year, people from 'midsized' communities (5,500 to 10,000 people), and people with more education were more likely to use the new trails (Brownson, Housemann et al. 2000).

A Chicago study examined objective physical activity along a 1.2 mile trail in an urban area and found that 9 percent of trail users were engaging in vigorous physical activity (fast walking, running, roller skating), 65 percent were moderately active (walking, bicycling), and 26 percent were engaging in low levels of physical activity (standing, sitting). Individuals engaging in high levels of physical activity were more likely to be men between the ages of 18 and 34. They were also more likely to use the trails during the morning, on weekdays, and during bad weather. The only other group who used the trail despite bad weather was moderately active individuals walking dogs.

Trail users in the Chicago study were also asked why they used the trails: 44 percent of users reported that pleasure or recreation was the most important reason, followed by 32 percent who said that it was health or physical training. Less than 10 percent of users reported social interaction, safety, scenery, or commuting as the reason for use. Respondents who reported

health or physical training as the most important reason for using the trail used the trails more often and utilized the trails alone. Along with commuters, they used the trail for a shorter length of time, were less likely to drive to the trail, and tended to use the same trail. Health-motivated users reported safety as a major barrier, although this may have been due to using the trail in the early morning. People who used the trail for pleasure were more likely to travel more than 20 miles to use the trail (Gobster 2005).

Barriers to Trail Usage

Barriers to trail usage can be analyzed to ascertain some of the determinants of use. Built environment barriers were noted in several studies. Troped, Saunders, et al. (2001) found that increases in self-reported and actual distance was related to decreased use of bikeway. There is an inverse relationship between perceived distance from the trail and the likelihood that trail was used—the greater the distance, the less likely the use of the trail. Not having to cross a busy street and not having to cross a steep hill (greater than 10 percent change in slope over 100 meters) were related to increased use of the Minuteman Bikeway in Boston.

Another potential barrier to use is lack of knowledge regarding the existence of trails. A study by Reed, Ainsworth, et al. (2004) in a rural southeastern community found that that there was very low agreement ($Kappa = 0.07$) between presence of trails and people's awareness of them. Thirty-three percent of people who knew about the trails reported using them. However, there is evidence that knowledge about the benefits of trails is widespread. One study found that 90 percent of adults in the U.S. were in favor of using local government funds for installing jogging/bicycle trails and recreational facilities (Brownson, Baker et al. 2001).

Safety and fear of crime are often mentioned as barriers to trail installation and trail use. A study by the Rails-to-Trails Conservancy (1998) examined both minor and more serious incidents on urban, suburban, and rural trails. They found that there were no burglaries in homes adjacent to the trails in urban areas and the rate was 0.01 percent for suburban rail-trails. While minor infractions (graffiti, littering, and damage to property) occur more frequently along urban trails than suburban or rural trails, severe crimes do not occur at high rates, making trails safer than other public spaces.

Trail Interventions

A number of interventions focused on access have been used to reduce some of the barriers to trail use. For example, Minnesota's Comprehensive State Bicycle Plan attempts to increase pedestrian travel by building bikeways, offering education and safety programs, and hiring a full-time bike coordinator. A survey found that adults in Minnesota bike twice the national average, with biking for transportation accounting for half of all of these miles (Barnes 2004). Other examples of enhanced access interventions do not include the construction of additional trails. In Germany, bicycle share of urban trips increased 50 percent from 1972 to 1995 with this increase largely due to public policies that increased the safety, speed, and convenience of cycling. This was accomplished by, in most cases, giving precedence to cyclists over cars. In addition amenities were added for bikers such as bike racks at transit stations, bike rental facilities, and an integrated signage system. Outreach activities included safety training for children as well as planning festivals and giving awards. Policies were implemented that made automobile use more expensive and inconvenient such as reducing speed limits for cars, eliminating all free parking in the city core and decreasing the number of parking spaces, and making some streets one-way for cars and two-way for cyclists (Pucher 1997).

The importance of encouraging trail usage is not only to promote awareness of alternative transportation methods to access work, play, or errands, but also to promote the health benefits of trail usage in terms of increased opportunities for physical activity. Research has been conducted to ascertain potential health benefits related to trail use. Vuori, Oja, et al. (1994) evaluated a trail use intervention in Finland. At the end of the 10-week intervention they found that physically active commuting to work (average of 1 hour per day for 10 weeks) increased VO2 max (maximum volume of oxygen consumed per kilogram of body weight per minute) by 4.5 percent. VO2 max is the maximum amount of oxygen in milliliters, one can use in one minute per kilogram of body weight. Those who are more fit have higher VO2 maximums and are able to exercise more intensely. Maximum treadmill times were increased by 10.3 percent, and HDL cholesterol (good cholesterol) by 5 percent (Vuori, Oja et al., 1994).

In addition to the evidence to suggest that the availability of trails and their promotion is related to increased physical activity and improved cardiovascular function, there is evidence of additional benefits. A study of trails users found that only a small minority (4 percent) of users were using the trail solely for exercise most users reported additional benefits including social, spiritual, physical, and time spent in nature (Bichis-Lupas and Moisey 2001). The Oregon Department of Transportation (1995) stated that some of the benefits to cycling were economic, such as increased tourism from cyclists while others were more intangible such as increased quality of life, feelings of safety, sense of community, social interactions, and enhanced access for children and the elderly.

While trails provide places for people to be physically active, it is important to ask the question: is this new physical activity that is occurring because the trail exists or are people simply using the trail instead of being active at another location? If the trail simply provides another location (i.e. no net increase in physical activity) then the trail cannot be said to affect an individual's physical activity levels and subsequent health outcomes. Conversely, if the person was engaging in physical activity on the trail as opposed to being sedentary elsewhere, then the physical activity performed on the trail is additional physical activity and the health outcomes can be attributed to the existence and promotion of the trail. From the handful of studies that have explicitly examined substitution of physical activity as well as all of the information available about trail use and physical activity, one can conclude that trails and their promotion do lead to a net increase in physical activity for a percentage of users. While the exact percentage is uncertain it is likely that 25 percent to 50 percent of the activity performed on trails can be attributed to the existence of the trail.

2.3 Vulnerable Populations

There is mounting evidence to support the assumption that poorer people have poorer health because they live in places that are unhealthy, although the relationship is complex (Baum & Palmer, 2002). For the purposes of this research, “vulnerable” populations are considered to include socioeconomic status, people of color, female-headed households, low educational attainment, and persons with disabilities. Research often also includes children and the elderly

as “dependent” populations. There are recognized health disparities in vulnerable populations, such as higher rates of chronic disease, infant mortality, and certain cancers.

In a study of collective efficacy and built environment features, the presence of parks and neighborhood disadvantage were significant predictors of collective efficacy. One study indicated that residents of high poverty neighborhoods live on average eight years less than non-poverty neighborhoods (Bhatia, Rivard & Seto, 2006). In addition, involuntary displacement and gentrification also diminish social capital by removing people from their established social networks and support systems, which has physical and mental health implications (Bhatia et al., 2006). Neighborhood change, whether in terms of gentrification and displacement or increasing crime and deterioration, can be stressful for long-time residents who feel unable to control the events surrounding them which can have negative mental and physical health repercussions (Baum & Palmer, 2002).

Individual characteristics such as gender, race, and age have been shown to affect the relationship between physical activity and the built environment (Ross, et.al, forthcoming March 2012). A few studies help illustrate the potential influence of individual factors. Several studies demonstrated links between gender, socioeconomic status and active transportation (Kitchen, Williams & Chowhan 2011, De Bourdeaudhuij, Sallis & Saelens 2003, Baig, Hameed, Li, Shorthouse, Roalfe & Daley, 2009). For example, in a longitudinal study of physical activity in Australian middle-aged adults, statistically significant differences were found between socioeconomically “advantaged” and “disadvantaged” neighborhoods (Turrell et al., 2010). In a study of active commuting in the Netherlands (given a supportive built environment), adolescents from non-Western backgrounds were more likely to walk than cycle to school, suggesting the importance of culture in affecting attitudes toward transportation modes (Bere, van der Horst, Oenema, Prins & Brug 2008).

In addition, the built environment may also encourage or discourage physical activity by age group. Research has found that some age groups, especially children and the elderly are differentially affected by aspects of urban form (Frank, Engelke & Schmid, 2003; Lockett, Willis & Edwards 2005; de Vries, Bakker, van Mechelen & Hopman-Rock, 2007). A study in the

Netherlands demonstrated that the number of days youth (6-11 years) met physical activity recommendations increased with increased access to sports facilities, greenspace and residential areas with limited access to traffic while parking spaces, intersections, and heavy bus and truck traffic were associated with less activity (de Vries et al., 2007). Traffic speed is the key determinant for pedestrian injury risk for children (Jacobsen et al., 2000). Traffic safety improvements in California resulted in a 65 percent increase in walking, and a 114 percent increase in biking to school among children (Staunton, Hubsmith & Kallins, 2003).

Since many older adults cannot perform vigorous physical activities they typically walk for exercise (Feskanich, Willis & Colditz, 2002; Tudor-Locke, Jones, Myers, Paterson & Ecclestone, 2002). In a six-year longitudinal study, older adults who walked a mile at least once a week were significantly less likely to develop functional limitations (Miller, 2000; Feskanich et al., 2002). Walking also improves cardiovascular endurance, balance and flexibility (King et al., 1998). A study in Seattle found significant relationships between community form and level of activity among seniors (Frank et al., 2003). Seniors in Ottawa, Canada, reported that traffic hazards and fear of falling are barriers to walking. Respondents reported that they would be assisted by convenient routes and destinations, good public transportation, aesthetics, benches, and restrooms (Lockett, Willis et al. 2005). Walking as a form of regular physical activity is also important for older adults with disabilities as a means to maintain their functional abilities and independence (Miller et al., 2000; Dean & Shepherd, 1997; Brach et al., 2003) and to decrease the chance of increasing their disability (DiPietro, 1996; Ettinger et al., 1997; Spirduso & Cronin, 2001; Hillsdon, Foster & Thorogood 2005).

3. Existing Baseline Conditions

The research team created an inventory of the existing characteristics of the study area. This information included both physical characteristics such as: land use, zoning designations, infrastructure patterns (roads and sidewalks), community facility locations, and park locations among other data. Information about the existing population was collected as well. This included the most recently available socio-economic data related to age, gender, physical activity levels,

employment status, poverty rates, vulnerable population status, and commute patterns for the census tracts located fully or partially in the study area.

The existing conditions data inventory served several purposes. The data provided a baseline standard of comparison of demographic characteristics to compare to the sample population data that was collected. It was also used to determine whether and where households defined as vulnerable were located in the study area. Typical commute patterns for the study area and the greater population were needed for the analysis, since this information has implications for a number of health implications. Finally the overall socio-economic profile was used to inform the recommendations regarding trail implementation, such as best practices to engage the surrounding populations in trail use to maximize the health benefits. This baseline data regarding the characteristics of the study area will also be compared to future changes in the study area as part of future research.

3.1 Physical Characteristics of the Study Area

An inventory of the existing physical characteristics of the study area was compiled and analyzed. The future land use, zoning designations, living unit density numbers in terms of land use, household types and density (clusters), activity center locations, block size, sidewalks coverage and connectivity, road classification, crash data, and neighborhood data were all collected for the existing study area site inventory.

Future Land Use

The future land use in the study area corridor is diverse and includes the following mix of land use categories: single family residential, low density residential, medium density residential, high density residential, low density commercial, high density commercial, mixed use, low density mixed use, medium density mixed use, high density mixed use, office-institutional, community facilities, industrial, transportation/communications/utilities, and open space. The categories and acreages are shown in the following

Table 1 and Figure 4.

Eleven officially designated City of Atlanta neighborhoods are totally or partially located in the study area (Figure 5). These surrounding neighborhoods have a more walkable urban form

than is typical of newer residential developments in the Atlanta region, since the majority of these neighborhoods were developed from the 1880s-1930s as a result of railroad and streetcar expansion. Typical block size is relatively small and walkable with a grid-type pattern.

Table 1: Future land uses in the study area.

Future Land Use Designations	Acres in Study Area
Single Family Residential	13.74
Low Density Residential	63.96
Medium Density Residential	42.44
High Density Residential	21.71
High Density Commercial	6.10
Low Density Commercial	57.73
Community Facilities	10.90
Mixed Use	63.67
High Density Mixed Use	0.50
Medium Density Mixed Use	9.47
Low Density Mixed Use	11.81
Office Institutional	8.36
Open Space	50.89
Industrial	24.35
Transportation/Communications/Utilities	5.39

The area also already has a fairly complete and connected existing system of sidewalks; however, the construction of the trail will dramatically shorten the distance between origins and destinations through the adjacent neighborhoods and greatly increase connectivity. The density of households varies throughout the study area with types of living units including single-family and multi-family units ranging from duplexes, triplexes, small apartment buildings, and a few larger apartment complexes. Figure 6 illustrates the distribution of living unit densities.

Parks

The study area is served by two major parks and seven neighborhood parks. The regional parks include Piedmont Park (170 acres), which is located at the northern access point of the trail and Freedom Park (120 acres) which crosses the trail. Piedmont Park is a major regional park destination and activity node. The Eastside Trail also crosses another existing linear park and trail system, Freedom Park. Freedom Park extends over two miles in an east/west direction and over one mile in a north/south direction. The location of these parks relative to the

Eastside Trail is significant as the Eastside Trail will provide continuity and access between both of these major parks, building a more connected system of trails and parks.

Crash Locations

In the final figure, locations of pedestrian-vehicle and vehicle-vehicle crashes within the study area are shown. Crashes occurred throughout the study area, but are concentrated along the Ponce de Leon Avenue, Monroe Drive and Boulevard corridors. Crashes occurred near the intersection of Ponce de Leon Avenue with the Eastside Trail, as well as near the northern end of the Eastside Trail at Monroe Drive and Virginia Avenue. See Figure 7.

Atlanta BeltLine Eastside Trail

Existing Conditions - Future Land Use

Future Land Use Designations

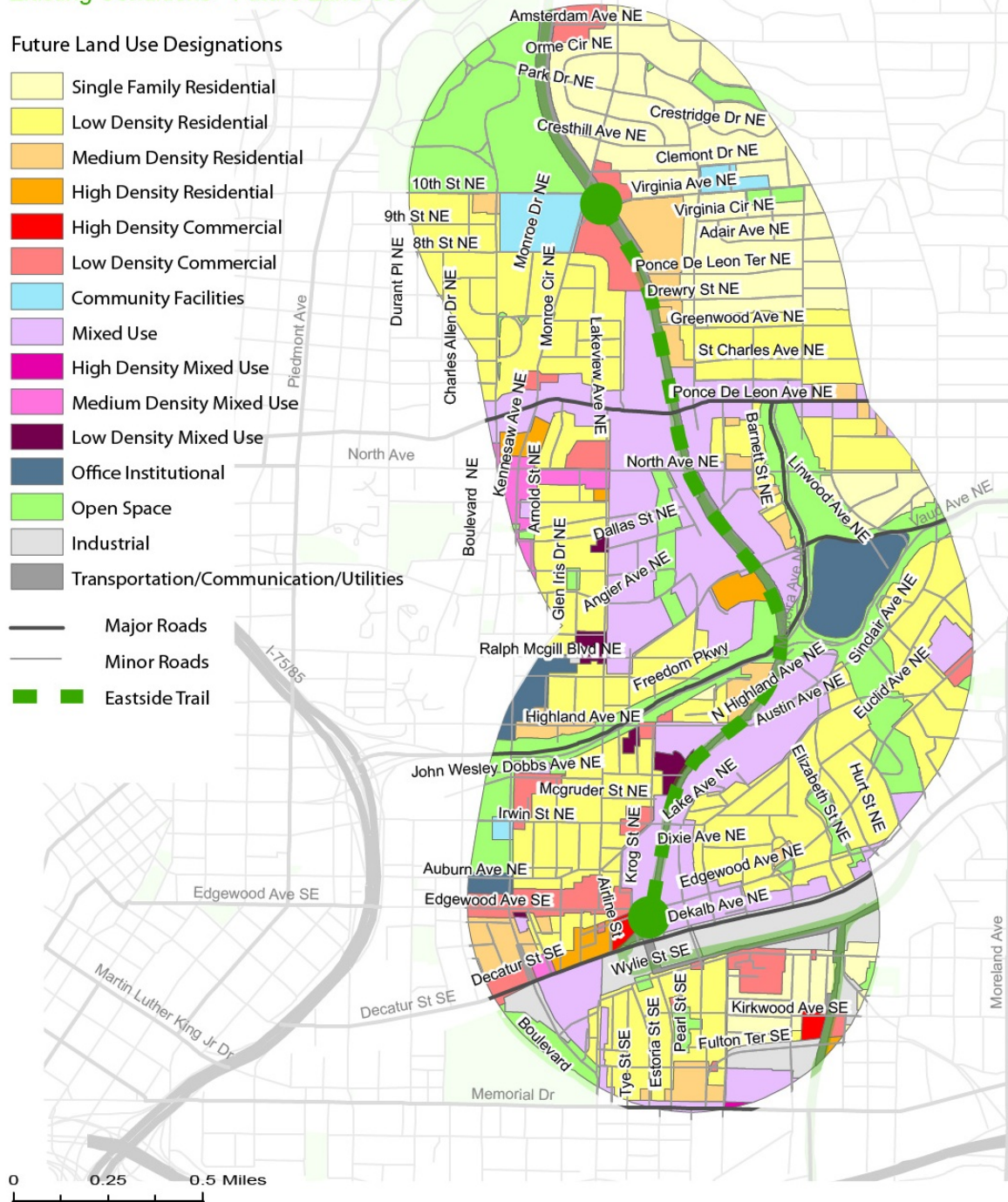


Figure 4: Future land use designations in study area.

Atlanta BeltLine Eastside Trail

Existing Conditions

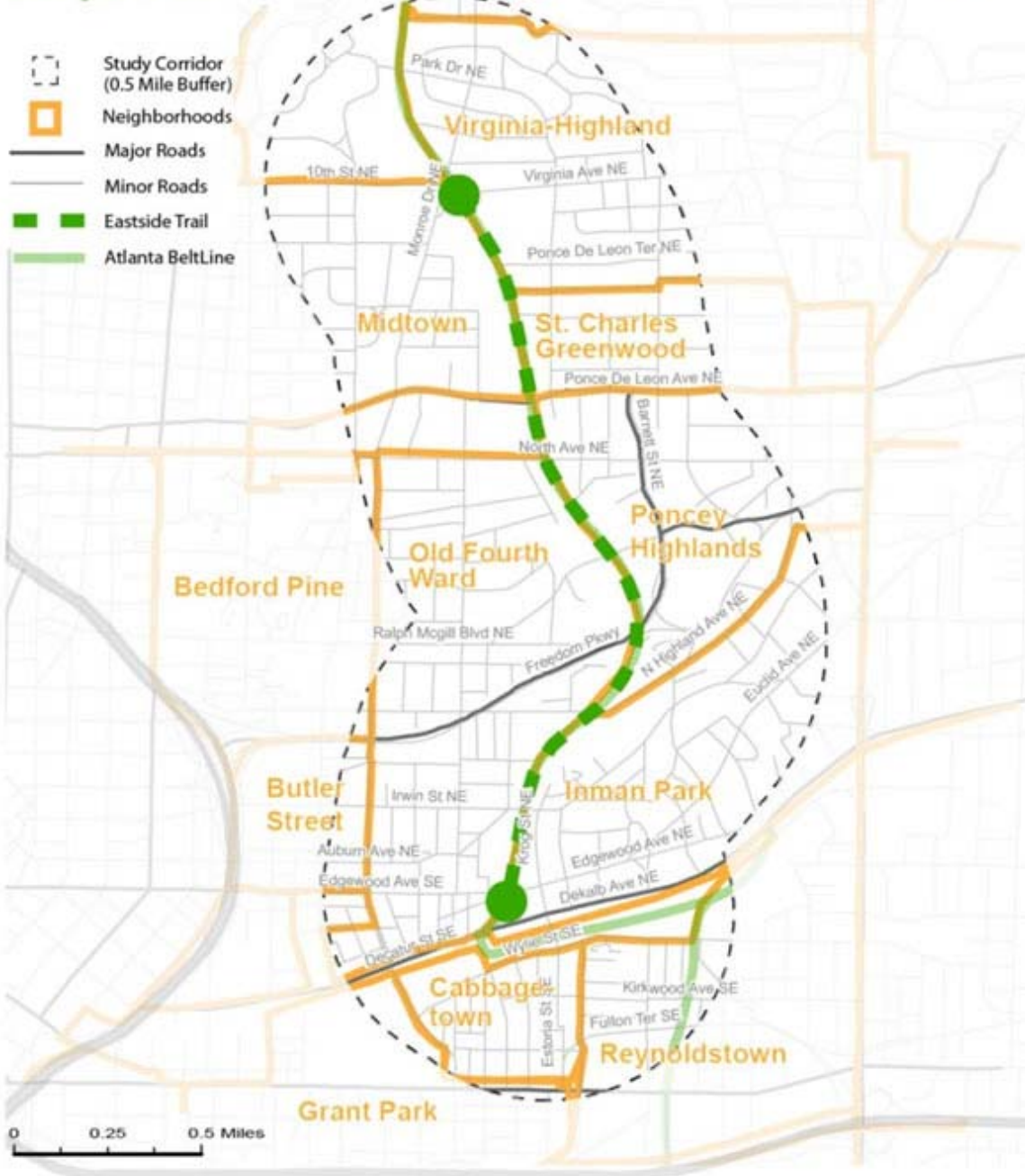


Figure 5: Atlanta neighborhoods located entirely or partially within the study area.

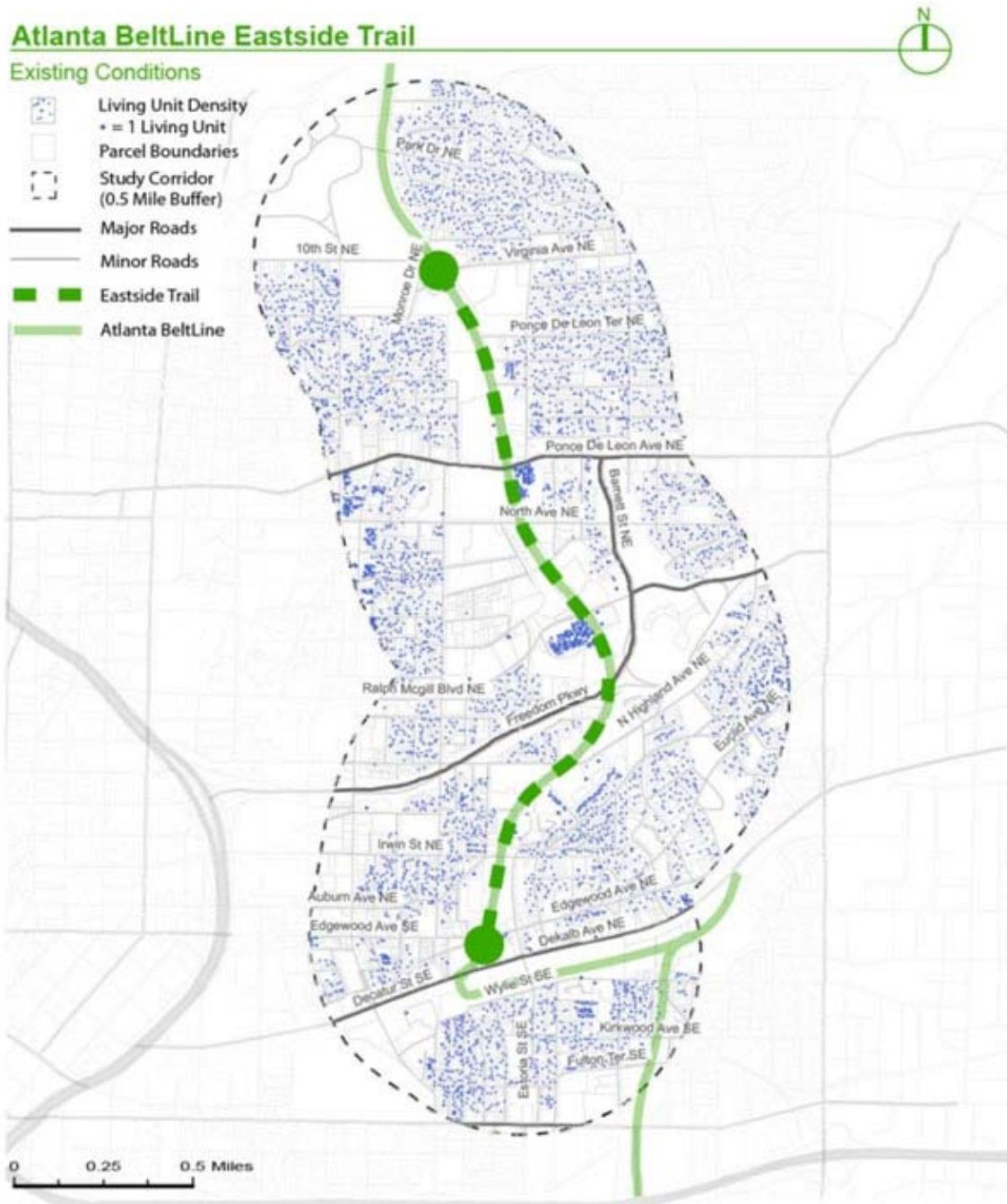


Figure 6: Density of existing living units located within the study area.

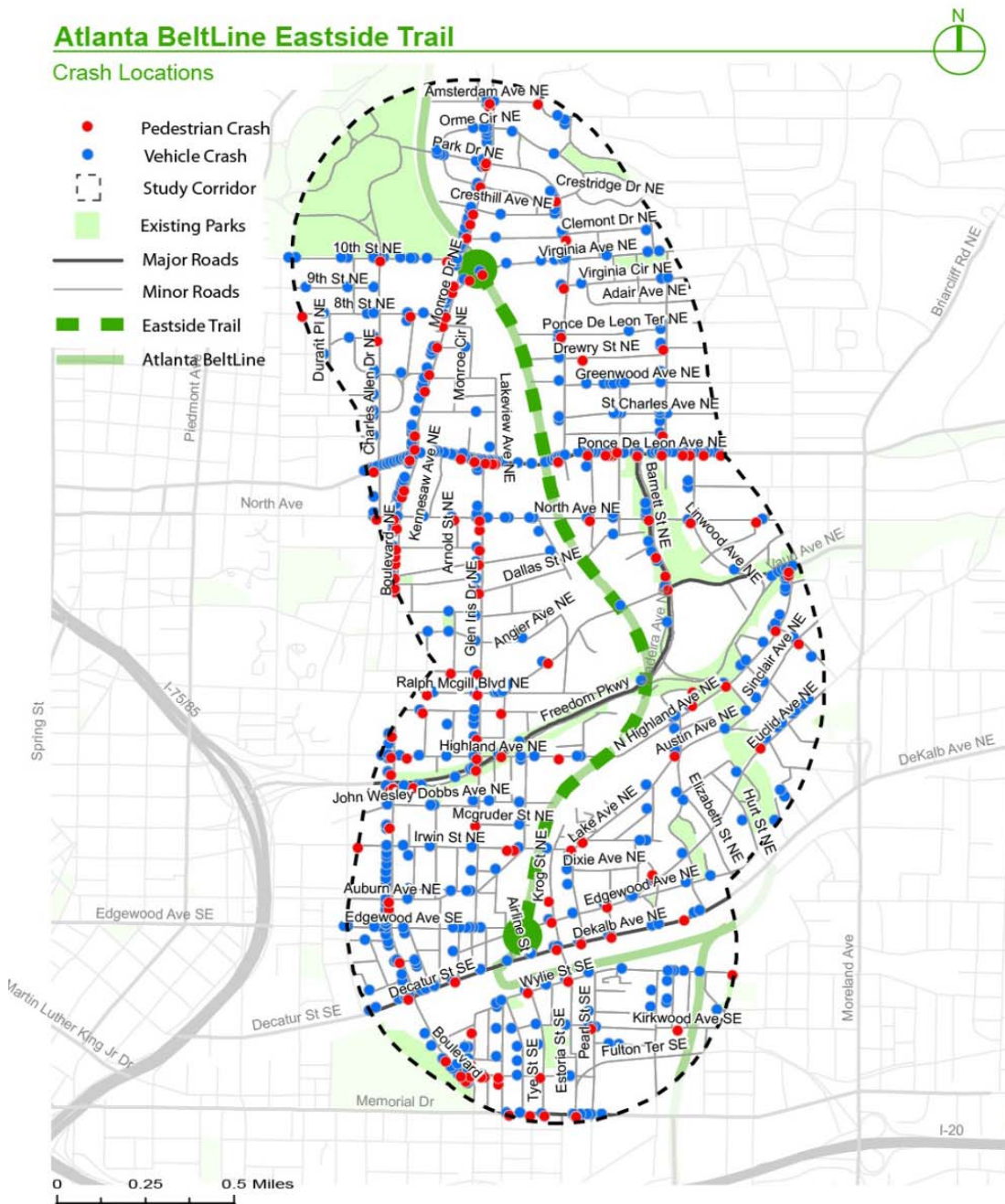


Figure 7: Locations of pedestrian and vehicle crashes within the study area.

3.2 Socio-Demographic Characteristics of the Study Area

Thirteen census tracts are partially contained within the study area and are shown in Figure 8, next page. The demographic characteristics of these 13 census tracts are also shown in the following tables. The results of the user observations and surveys have been compared to

the demographic characteristics of the surrounding population and these results are included in the following section 4.3 *Survey Results*.

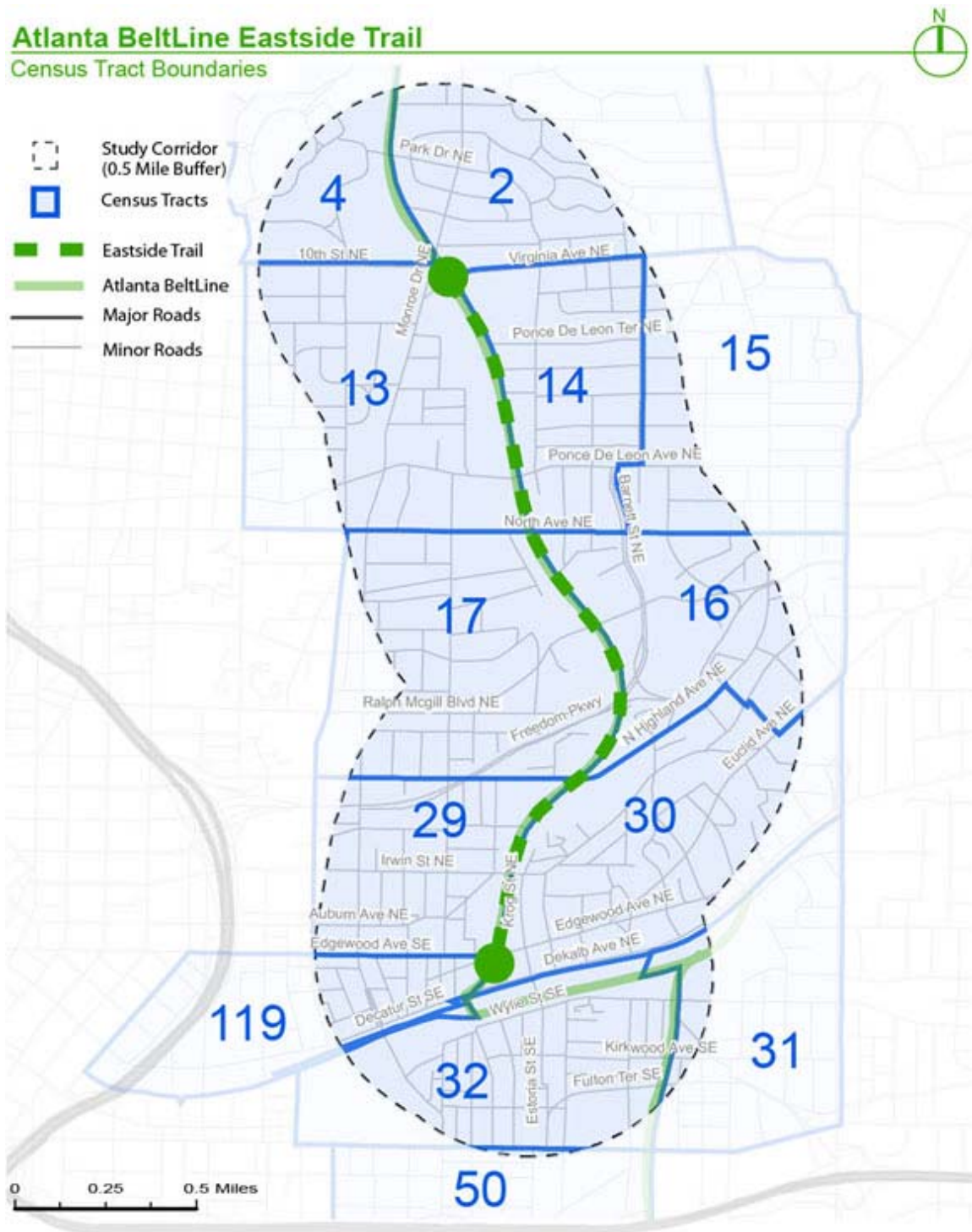


Figure 8: Census tracts located entirely or partially within the study area.

The following demographic data was also utilized to provide information regarding areas with a higher concentration of vulnerable populations in the study area. There is mounting evidence to support the assumption that poorer people have poorer health because they live in places that are unhealthy due to external factors. These factors include lack of education, poverty, and other interrelated negative conditions. Vulnerable populations were defined previously in this report as, “lower socioeconomic status, people of color, female-headed households, low educational attainment, and persons with disabilities.”

Other populations of note in this analysis include children and the elderly due to the unique health needs and challenges of these groups. As shown in the following figures, the study area is diverse economically and demographically.

The following figures and tables illustrate the age and gender distribution of the population residing in the study area. In almost all of the census tracts, the distribution of males to females is fairly equal with the exception of census tract 29 (65.9% female) and census tract 119 (65.5% male).

The following figures and tables also illustrate that the population in the study area is overwhelmingly between the ages of 18 and 45. All tracts have a majority of residents that are middle aged. Regarding the numbers of elderly individuals (over 65 years of age) and children (under 18), census tract 4 has the highest percentage of elderly residents (13.6%). The greatest percentage of children is found in census tract 17 with 27.6%.

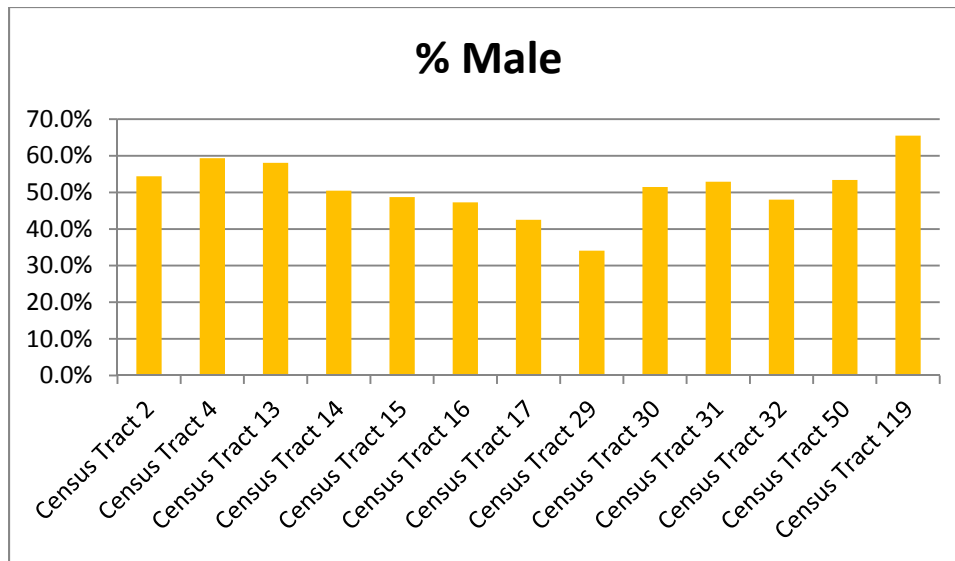


Figure 9: Percentage male population, by census tract

Table 2: Age and gender

Geography	Total Population	Average Household Size	Female Householder, no husband present	% Male	% Female	% Under 18	18 to 45	45 to 64	65 and older
Census Tract 2	6141.00	2.1	5.3%	54.4%	45.6%	17.7%	49.5%	27.3%	5.4%
Census Tract 4	1672.00	1.6	1.7%	59.3%	40.7%	12.9%	39.5%	34.0%	13.6%
Census Tract 13	4472.00	1.6	4.3%	58.1%	41.9%	3.8%	62.1%	25.8%	8.3%
Census Tract 14	2441.00	1.6	4.1%	50.5%	49.5%	6.6%	74.2%	17.5%	1.6%
Census Tract 15	4429.00	1.8	4.5%	48.7%	51.3%	11.4%	62.5%	21.7%	4.4%
Census Tract 16	2000.00	1.7	7.7%	47.3%	52.7%	9.5%	71.8%	16.9%	1.9%
Census Tract 17	2553.00	2	21.5%	42.5%	57.5%	27.6%	56.1%	11.9%	4.4%
Census Tract 29	1569.00	1.6	6.5%	34.1%	65.9%	9.5%	72.9%	13.9%	3.7%
Census Tract 30	2682.00	1.9	2.2%	51.5%	48.5%	13.1%	60.0%	22.9%	4.1%
Census Tract 31	1731.00	2.6	14.1%	52.9%	47.1%	17.8%	54.2%	21.8%	6.2%
Census Tract 32	1958.00	1.7	7.0%	48.0%	52.0%	14.8%	62.5%	18.6%	4.1%
Census Tract 50	2147.00	2	6.2%	53.4%	46.6%	10.7%	64.1%	12.5%	12.6%
Census Tract 119	1814.00	1.6	6.8%	65.5%	34.5%	12.1%	53.9%	29.2%	4.9%
TOTAL (All Selected Census Tracts)	35609.00								

Atlanta BeltLine Eastside Trail

Age by Census Tract



Percent 65 and Over

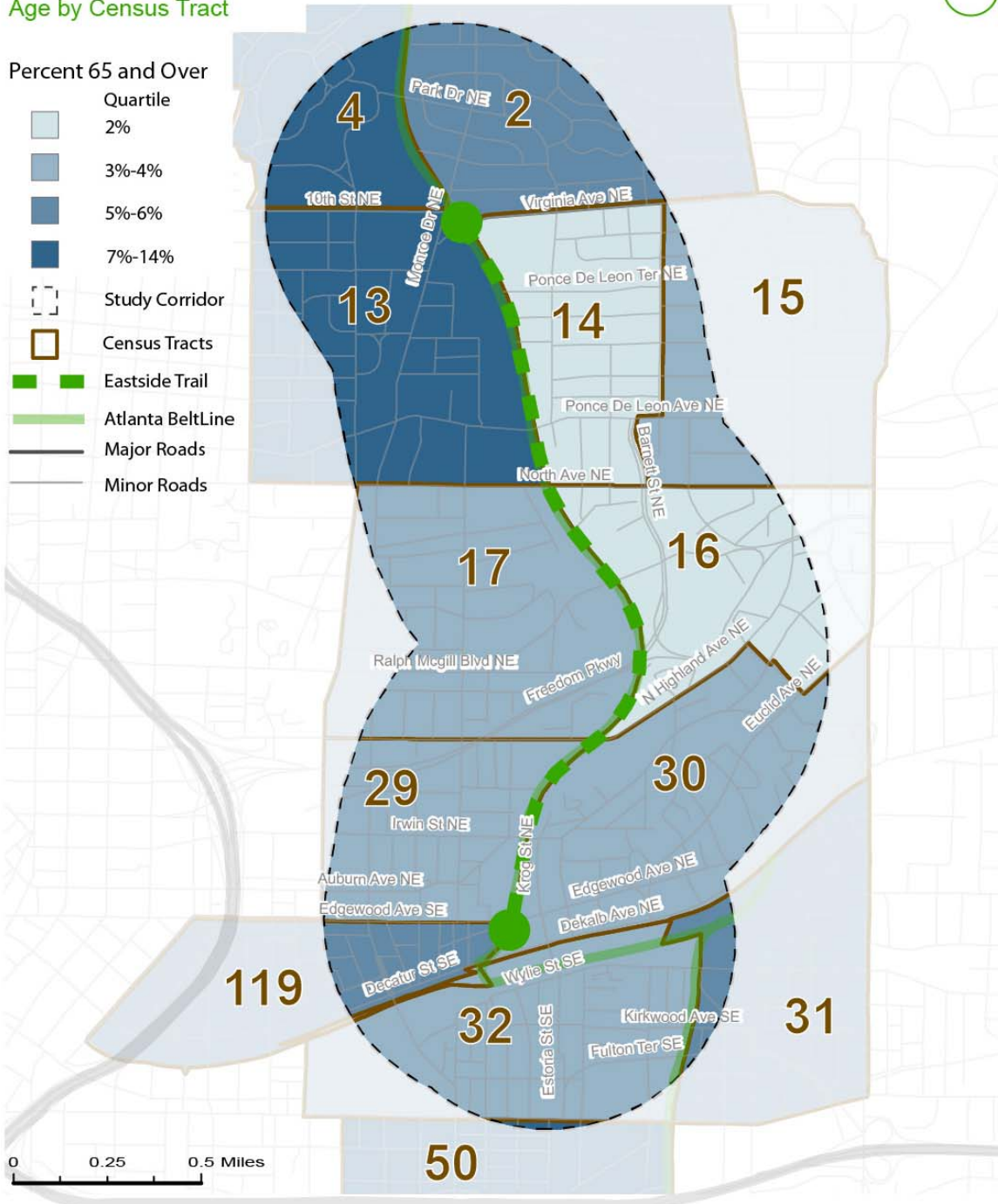
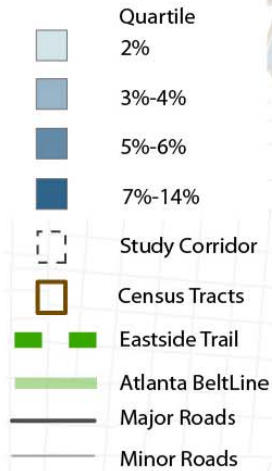


Figure 10: Percentage of study area residents who are over 65, by census tract.

Atlanta BeltLine Eastside Trail

Age by Census Tract

Percent Aged 18 - 64

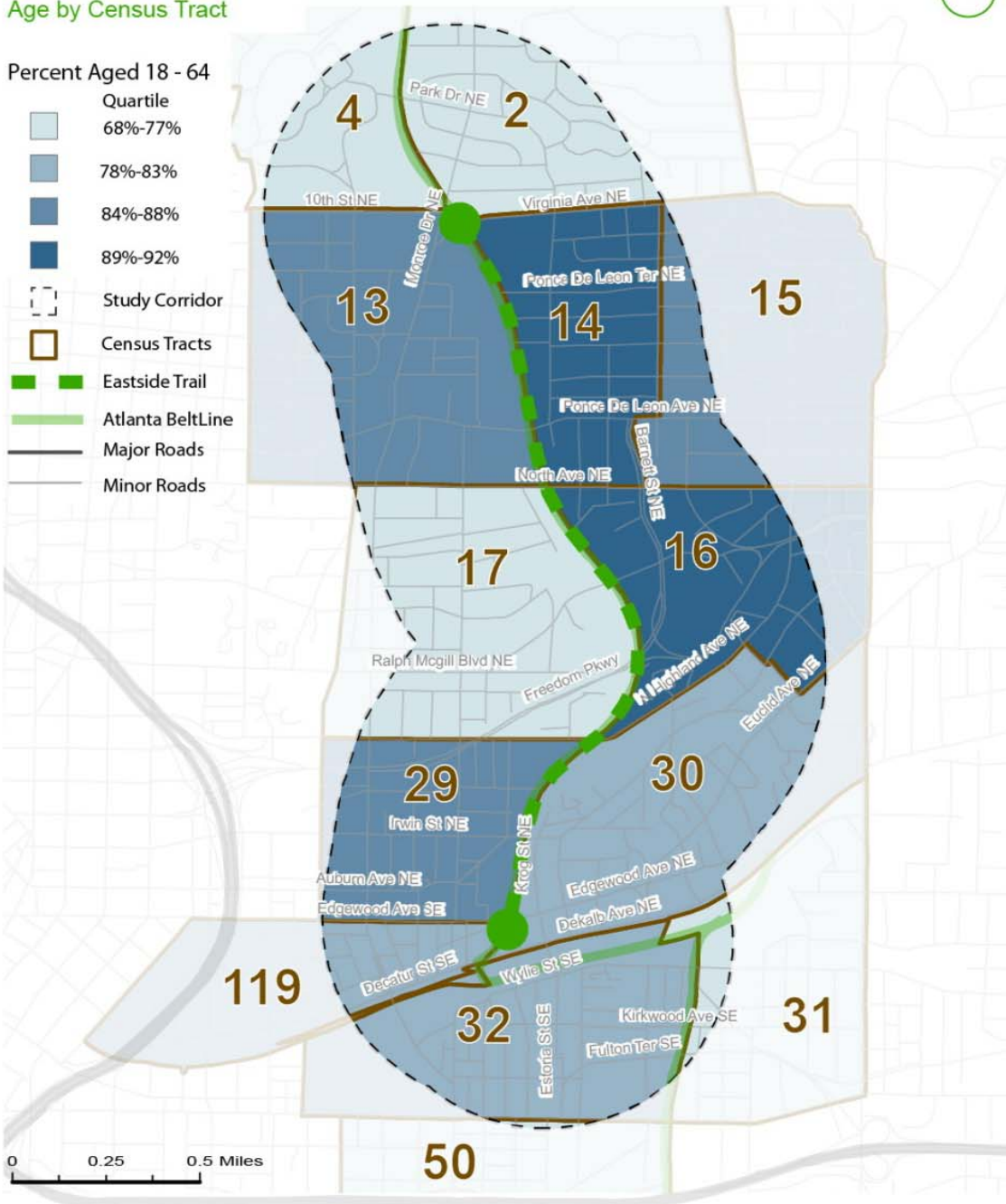
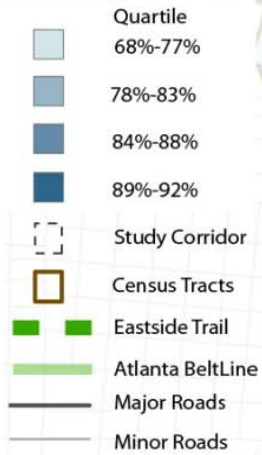


Figure 11: Percentage of study area residents between 25 and 64, by census tract.

Atlanta BeltLine Eastside Trail

Age by Census Tract



Percent 18 and Under

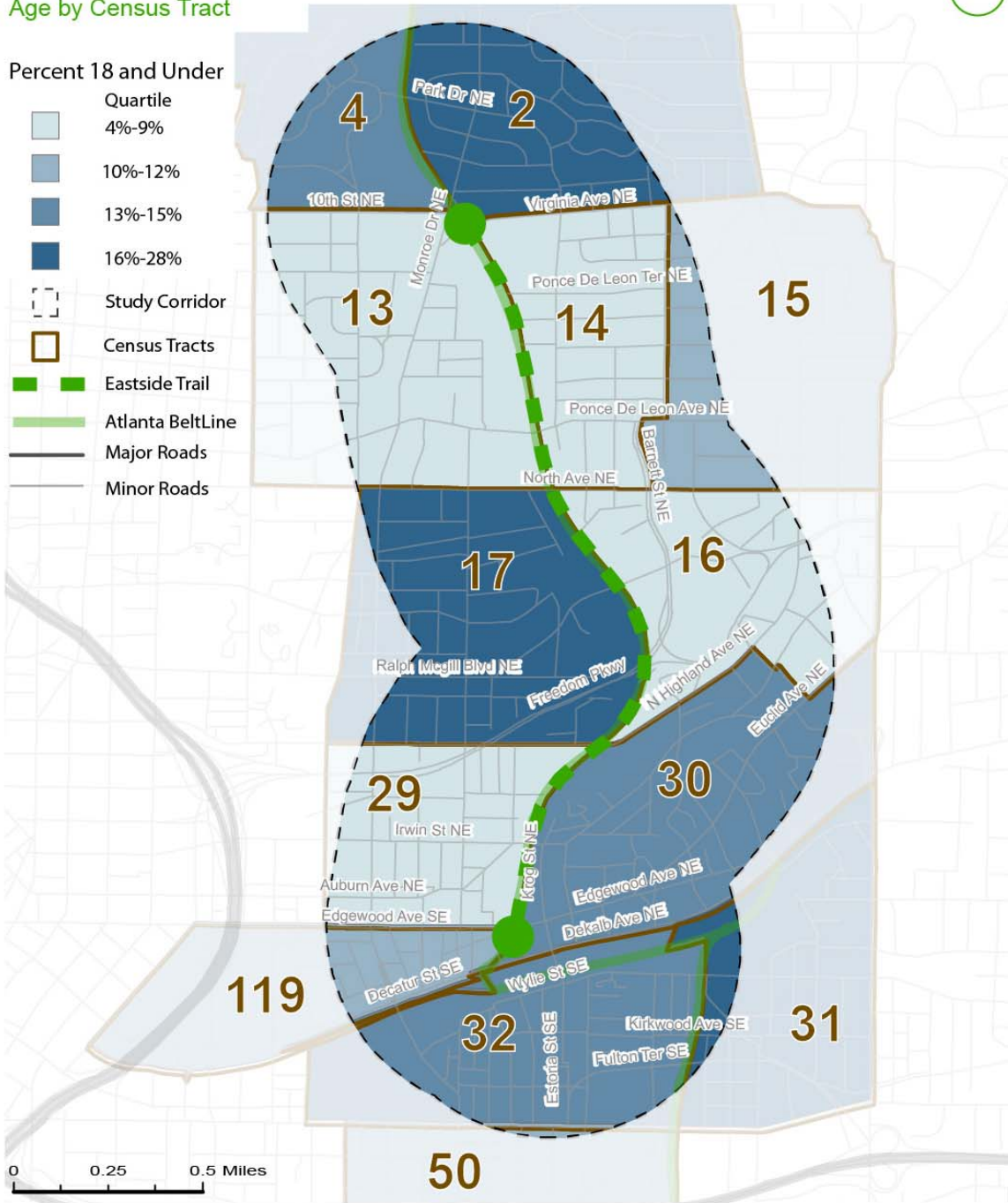
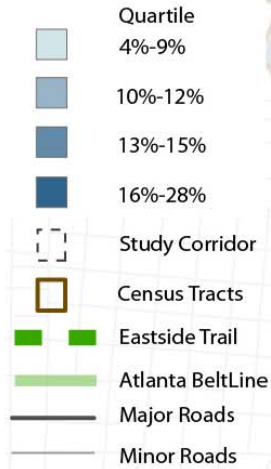


Figure 12: Percentage of study area residents under 18, by census tract.

The following figures and tables show the racial distribution of the study area population. The major groups represented in the study area include Caucasian and African American. Tracts

with a higher number of individuals of minority races or ethnicities could indicate a vulnerable population.

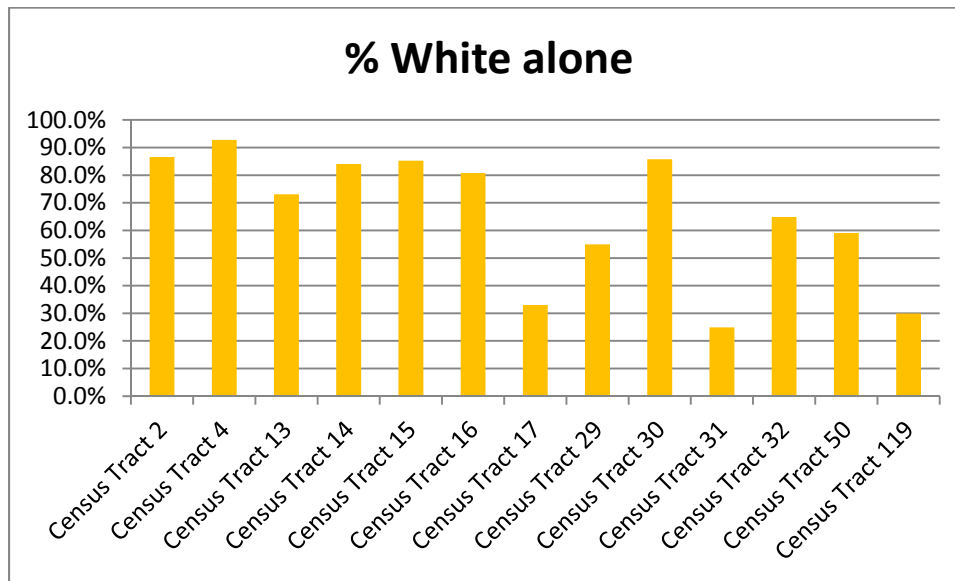


Figure 13: Percentage of population that is white alone, by census tract

Table 3: Race/ethnicity

Geography	White alone	Black alone	Hispanic or Latino	Asian alone	Other
Census Tract 2	87%	7%	2%	4.0%	2.5%
Census Tract 4	93%	4%	2%	2.1%	0.7%
Census Tract 13	73%	19%	4%	1.9%	5.6%
Census Tract 14	84%	6%	2%	8.2%	1.4%
Census Tract 15	85%	7%	7%	5.1%	2.3%
Census Tract 16	81%	16%	3%	0.8%	2.7%
Census Tract 17	33%	64%	3%	0.0%	2.7%
Census Tract 29	55%	33%	3%	8.3%	4.2%
Census Tract 30	86%	6%	1%	2.5%	5.9%
Census Tract 31	25%	72%	0%	0.0%	2.9%
Census Tract 32	65%	32%	2%	2.6%	0.3%
Census Tract 50	59%	25%	13%	1.3%	15.1%
Census Tract 119	30%	61%	8%	5.0%	3.8%

Atlanta BeltLine Eastside Trail

Race by Census Tract

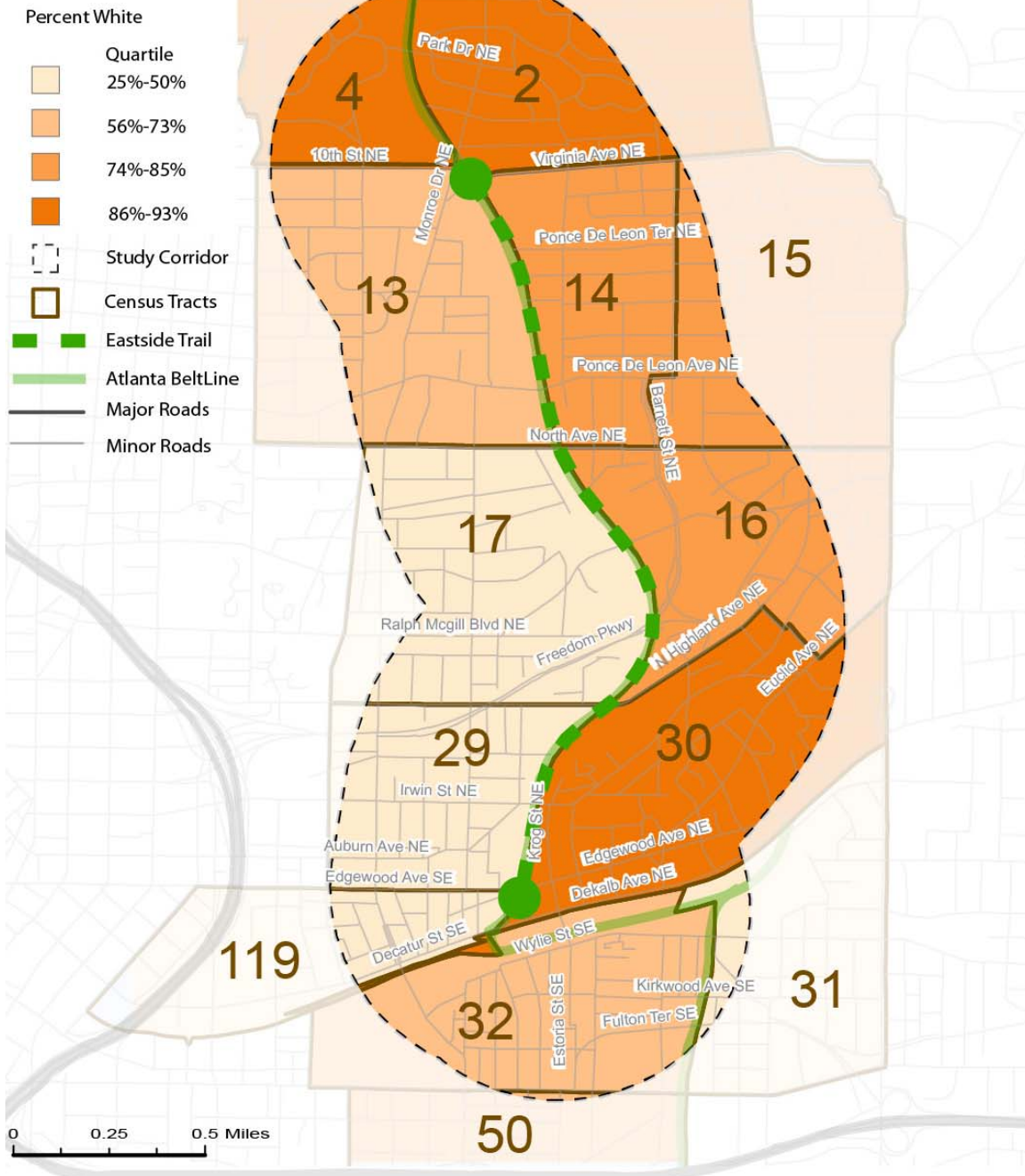


Figure 14: Percentage of study area residents who are white alone, by census tract.

Atlanta BeltLine Eastside Trail

Race by Census Tract

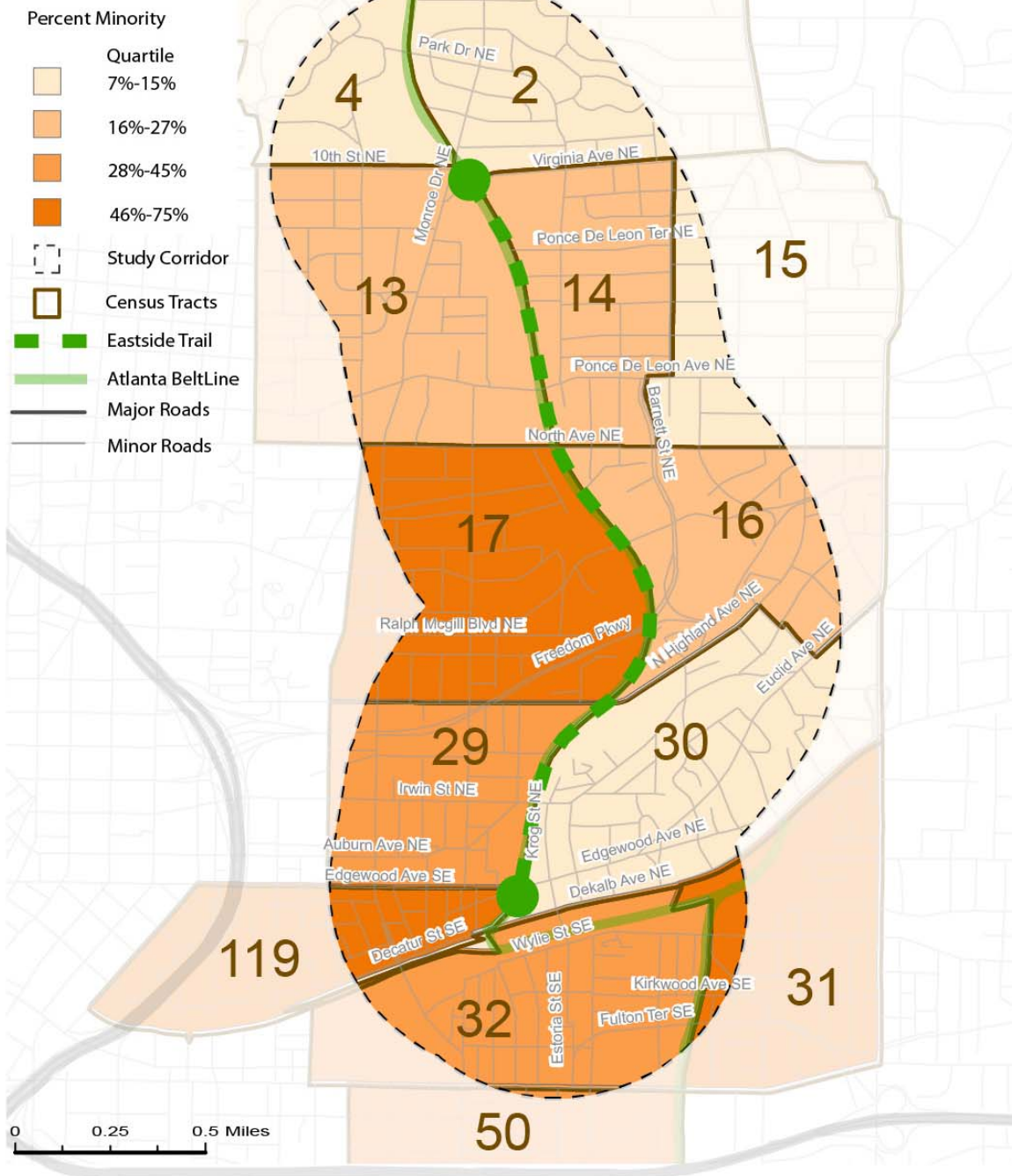


Figure 15: Percentage of study area residents who are minorities, by census tract.

The following tables and figures indicate educational attainment and employment rates for the study area population. This data illustrates the wide disparities that exist in the study area. The percentage of individuals aged 25 and older without a high school diploma ranges from 0% in

census tracts 4, 14, and 16 to 26% in census tract 119. This trend of major disparity is repeated in the figures for the rate of child poverty in the study area, which ranges from 0% in census tracts 4, 13, and 14 to 82% in census tract 17 and 80% in census tract 119.

Table 4: Education and unemployment

Geography	Pop 25 yrs or older less than HS Ed	Over 16 in labor force	Not in labor force (not actively seeking employment, includes retired)	Unemployed (actively seeking employment)
Census Tract 2	2%	82%	13%	4%
Census Tract 4	0%	74%	18%	4%
Census Tract 13	7%	76%	26%	3%
Census Tract 14	0%	86%	8%	4%
Census Tract 15	7%	78%	20%	6%
Census Tract 16	0%	88%	7%	5%
Census Tract 17	11%	81%	8%	13%
Census Tract 29	5%	84%	10%	2%
Census Tract 30	2%	86%	4%	5%
Census Tract 31	19%	65%	28%	15%
Census Tract 32	10%	89%	13%	4%
Census Tract 50	23%	76%	17%	6%
Census Tract 119	26%	65%	30%	16%

Table 5: Median income and poverty

Geography	Under 18 Poverty	18 to 64 poverty	65 and over poverty	Median Household Income
Census Tract 2	8%	5%	4%	\$88,021
Census Tract 4	0%	9%	0%	\$100,125
Census Tract 13	0%	7%	0%	\$66,392
Census Tract 14	0%	7%	0%	\$69,473
Census Tract 15	3%	18%	15%	\$53,246
Census Tract 16	24%	9%	0%	\$61,497
Census Tract 17	82%	27%	44%	\$34,942
Census Tract 29	19%	17%	60%	\$52,426
Census Tract 30	14%	10%	0%	\$76,714
Census Tract 31	25%	33%	34%	\$39,688
Census Tract 32	37%	13%	55%	\$56,071
Census Tract 50	53%	20%	0%	\$47,378
Census Tract 119	80%	31%	16%	\$30,000

Atlanta BeltLine Eastside Trail

Poverty by Census Tract



Percent Poverty Rate
Children Under 18

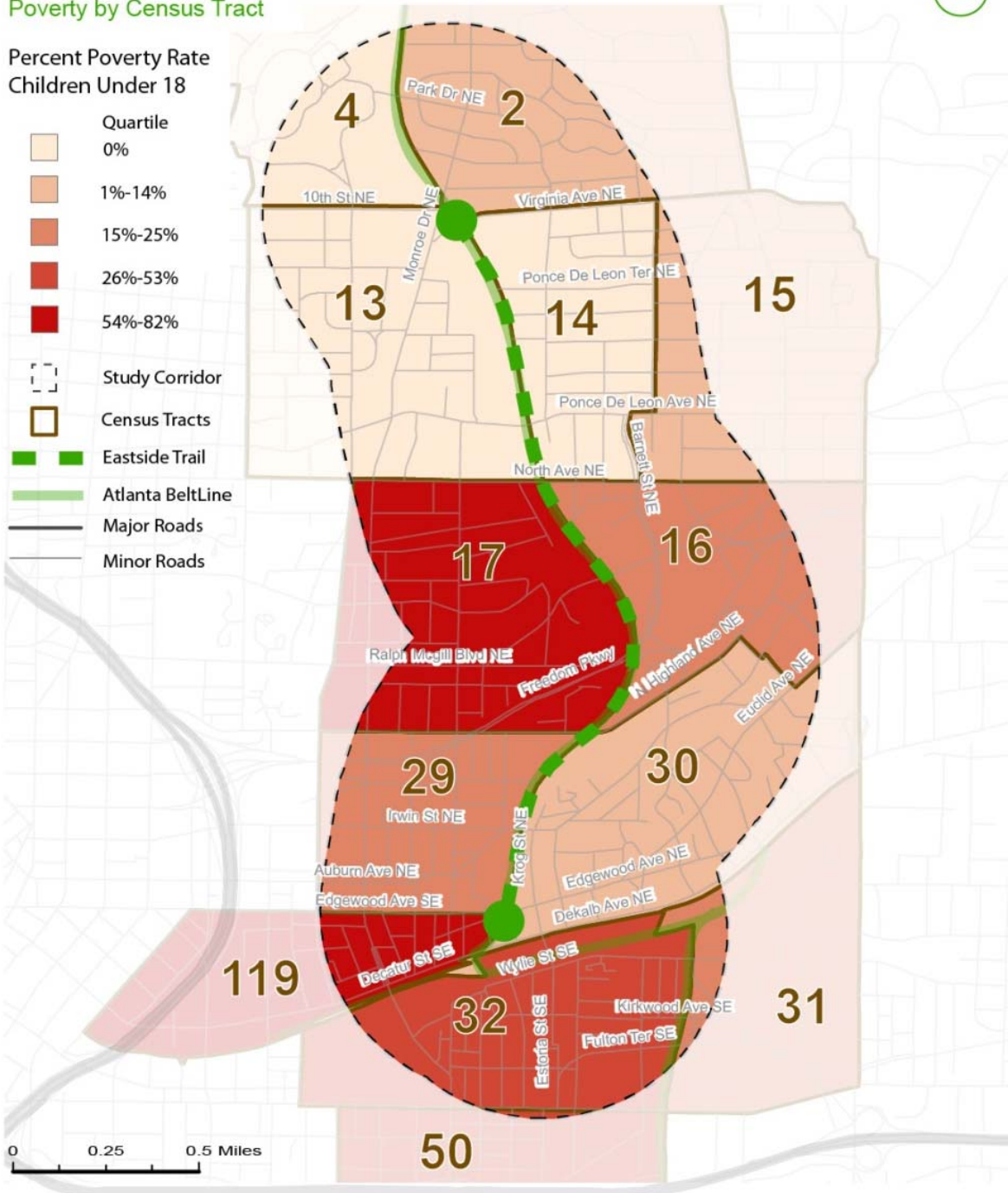
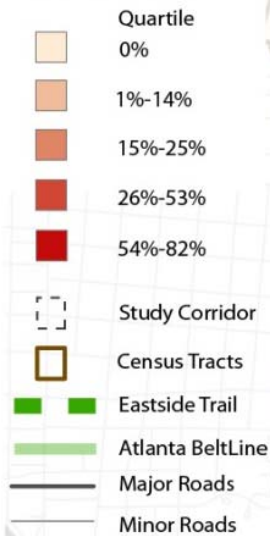


Figure 16: Study area residents under 18 living in poverty, by census tract.

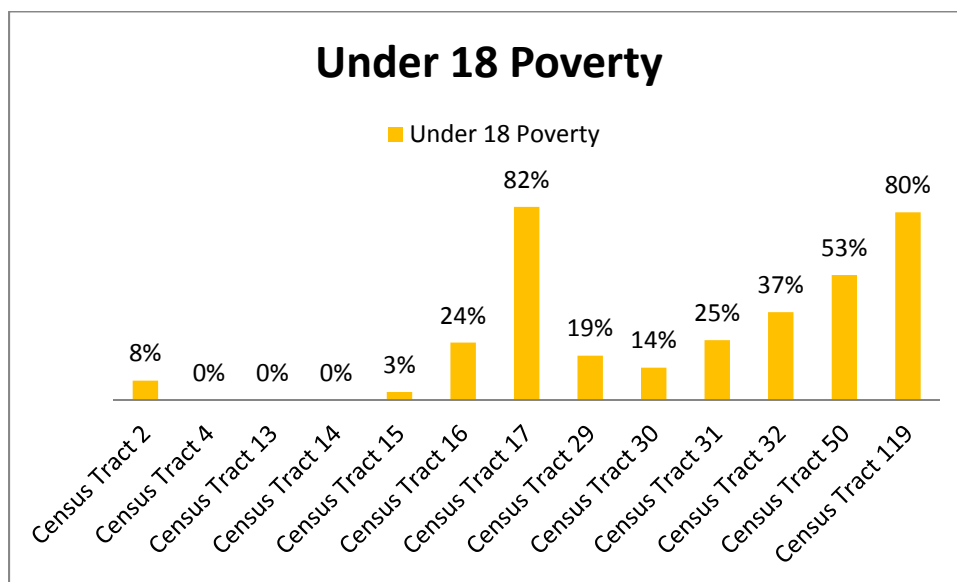


Figure 17: Percentage of population under 18 in poverty, by census tract

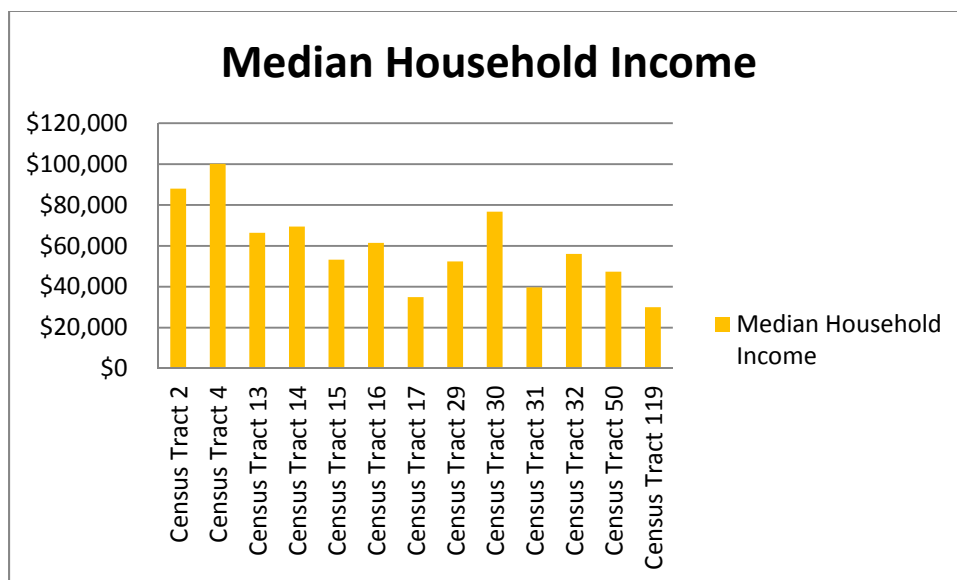


Figure 18: Median household income, by census tract

Information on the existing travel and commuting patterns of the populations residing in the study area census tracts was also collected. This data was needed for analysis due to the relationship between commuting time and mental health. This data was also used as a

comparison with the characteristics of the sample population. The majority of the population in all census tracts travels to work via car, truck, or van. In census tract 32, 89% of the population travels to work utilizing this mode of travel. However, in census tract 119, 26% of the population walked to work. Data showing the travel time to work for the study area population was also collected. The commute length time that appeared most frequently for all census tracts except one (census tract 16) was 10 to 19 minutes.

Table 6: Mode of transportation to work

Geography	Car, truck, or van	Public transportation (Includes Taxicab)	Bicycle	Walked
Census Tract 2	81%	5%	1%	2%
Census Tract 4	81%	2%	0%	8%
Census Tract 13	69%	4%	1%	9%
Census Tract 14	85%	1%	2%	2%
Census Tract 15	81%	5%	3%	5%
Census Tract 16	73%	9%	2%	4%
Census Tract 17	67%	12%	2%	9%
Census Tract 29	79%	8%	1%	3%
Census Tract 30	80%	5%	2%	2%
Census Tract 31	73%	24%	0%	2%
Census Tract 32	89%	3%	1%	2%
Census Tract 50	81%	1%	1%	3%
Census Tract 119	57%	15%	2%	26%

Table 7: Travel time to work

Geography	10 to 19 minutes	20 to 29 minutes	30 to 39 minutes	40 to 59 minutes	60 to 89 minutes	90 or More minutes
Census Tract 2	43%	17%	9%	9%	2%	0%
Census Tract 4	43%	22%	3%	4%	1%	1%
Census Tract 13	29%	20%	18%	7%	1%	1%
Census Tract 14	29%	32%	12%	6%	1%	0%
Census Tract 15	34%	29%	12%	9%	1%	1%
Census Tract 16	21%	37%	11%	6%	6%	1%
Census Tract 17	36%	20%	8%	2%	6%	7%
Census Tract 29	33%	28%	11%	8%	3%	3%

Census Tract 30	33%	18%	11%	4%	8%	2%
Census Tract 31	25%	17%	27%	11%	11%	3%
Census Tract 32	31%	27%	18%	2%	3%	0%
Census Tract 50	27%	19%	18%	12%	4%	0%
Census Tract 119	40%	22%	16%	6%	3%	0%

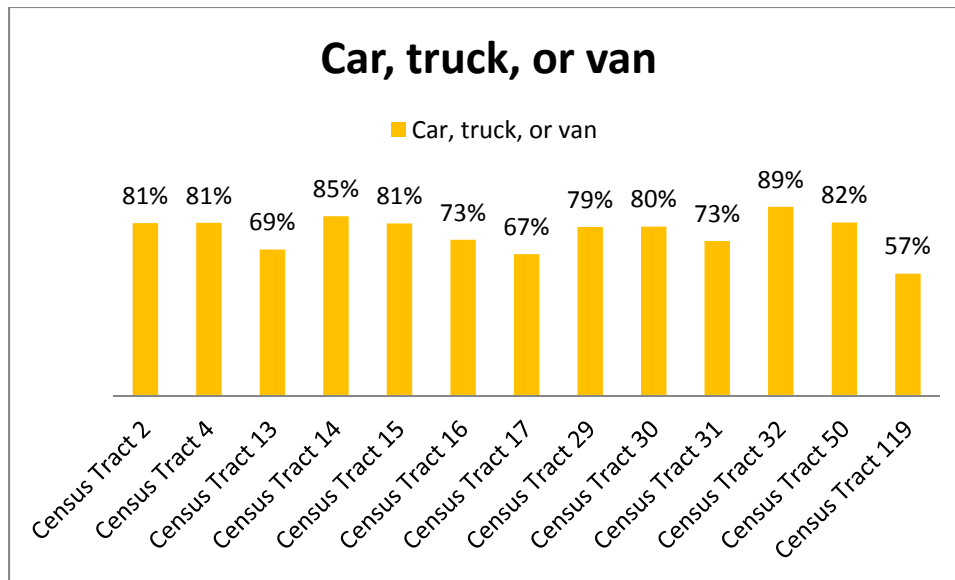


Figure 19: Percentage of population commuting by car, truck or van

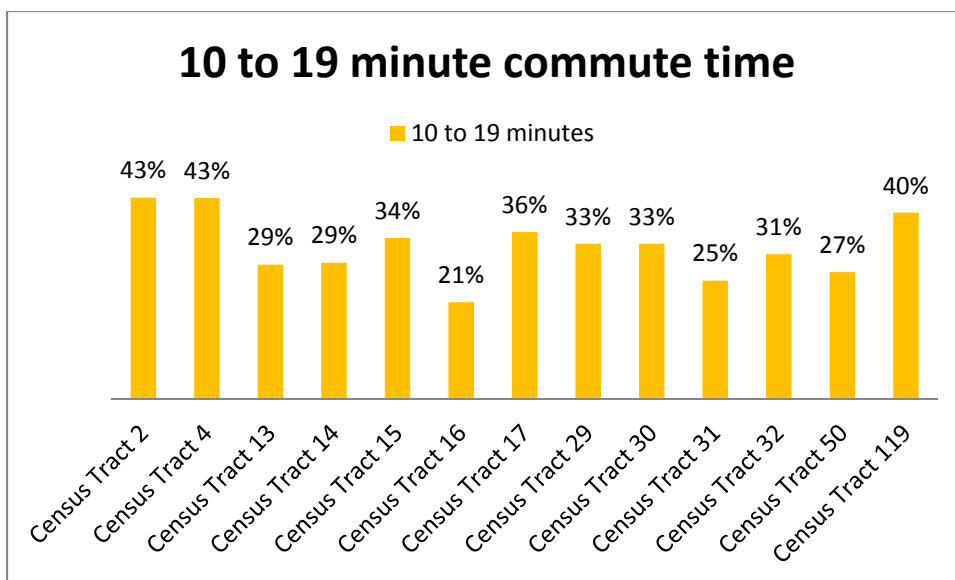


Figure 20: Percentage of population with 10 to 19 minute commute time, by census tract

As shown in Table 7 and Figure 20, the data indicates that much of the population residing in the study area adjacent to the trail has a very short commute time (10-19 minutes) relative to typical regional commute times. Census data also suggests that the vast majority of trips to work are by car (Figure 19), indicating that many short commute times have a high level of car commuting. Given that short trips could be more easily shifted to active modes of transportation (such as walking or bicycling) there is potentially great opportunity to increase active transportation in the study area by incorporating the new connectivity provided by the Eastside Trail.

4. Establishing Baseline Health Behavior

Two methods of assessment were utilized to establish the baseline health behaviors of the population along the Eastside Trail corridor study area. The first method employed by the research team included conducting surveys of a statistically significant sample of individuals to measure their level of activity in the form of in-person interviews of area residents and workers. These interviews were conducted with individuals observed actively using the temporary BeltLine trail and individuals observed along major linkage points connecting to the trail. The survey interview questions were written in a clear concise manner to be easily accessible to a wide audience.

The second method of assessment employed by the research team included conducting pedestrian and bicycle observations. The research team undertook this task to establish baseline rates of walking, bicycling, and other active travel at peak and off-peak times and locations in the study area corridor. Trained observers on the research team counted a sample number of physically active users and recorded relevant details.

Both research methods and approaches were reviewed and approved by the Georgia Institute of Technology Institutional Review Board for the protection of human subjects in research.

4.1 Methodology

For sampling purposes, the research team separated the trail at the intersection with Ralph McGill Boulevard into a northern segment and a southern segment. The northern segment therefore extended from Ralph McGill Boulevard north to the intersection of the trail with Monroe Drive. The length of this section is approximately 1 mile. The southern trail segment also began at Ralph McGill Boulevard and extended south to the intersection with DeKalb Avenue. The southern section is approximately 1.5 miles in length. Through field reconnaissance and preliminary observation of wear paths, the research team identified existing points along the existing gravel BeltLine Eastside Trail where users were accessing the temporary trail. Figure 21 illustrates two examples of wear path access points that were observed along



Figure 21: Examples of wear paths observed along the temporary gravel Eastside Trail.

the trail. Thirteen such access points were identified. In addition to the access point noted at Ralph McGill Boulevard, five access points were observed on the northern segment and seven access points were noted on the southern trail segment. The access points identified by the research team and the northern and southern trail segments are shown on Figure 22 below.

Each access point was assigned as a trail monitoring and observation point. A detailed protocol for interviewing subjects and for conducting observations was developed. All members of the research team were given a detailed briefing on the procedures to insure consistency across all research assistants. Researchers were then divided into two teams consisting of two individuals. Each team was assigned to either the northern or southern segment to monitor and conduct surveys. The teams moved along the trail spending an equal amount of time at each monitoring location. Each research team utilized an Observation Form to record where each observation was made. Each access point was assigned a numerical value beginning with 1 at Monroe Avenue in north and finishing with 13 for DeKalb Avenue in the south. If researchers came upon a trail user between access points, then they were recorded with a half. For example, a user encountered between Irwin St. (11) and Edgewood Ave. (12) was recorded by researchers as 11.5.

Atlanta BeltLine Eastside Trail

Trail Access Points

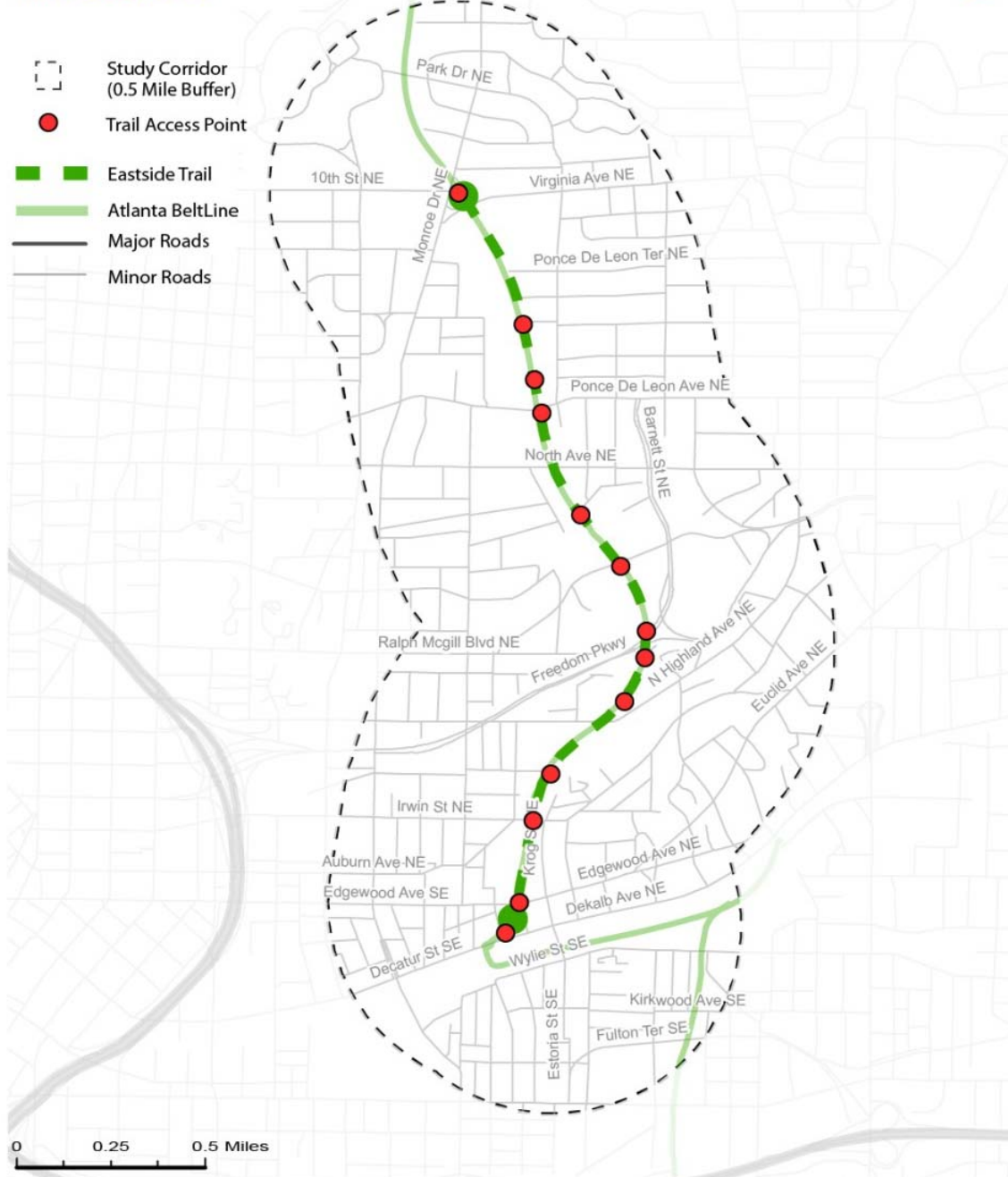


Figure 22: Trail access points.

Access Points:

Northern Segment Monitoring Locations

1. Monroe Drive
2. Greenwood Avenue

3. Behind Urban Body Salon and Paris on Ponce
4. Ponce De Leon Avenue
5. Angier Springs Road
6. Ralph McGill Blvd

Southern Segment Monitoring Locations

7. Ralph McGill Blvd
8. Historic 4th Ward Skate Park
9. Freedom Parkway
10. Behind Parish Restaurant (near North Highland Ave)
11. John Wesley Dobbs Avenue
12. Irwin Street
13. Edgewood Avenue
14. DeKalb Avenue

The baseline data for this population was collected through two methods: online surveys and intercept surveys. Intercept surveys were given in person to those using the trail at both peak and non-peak times. Surveys were conducted for two hours each in the morning (7:00-9:00 a.m.); midday (11:00 a.m.-1:00 p.m.); and evening (4:00 p.m.-6:00 p.m.) on two days (Wednesday and Saturday) over the course of two weeks. The field observations and surveys were only conducted during weather conditions conducive to trail use. Intercept surveys were also given to individuals located along key linkage points. Participant's signatures were collected on the consent form prior to administering the survey questions. The on-line survey also included an on-line consent form. The children included in the study were given a child assent form, to explain the purpose of the study and to clarify the voluntary nature of the survey. Parental permission was acquired prior to researchers collecting survey data from children under the age of 18. No data was collected from children without parental consent. Direct user observation of activity and user counts were conducted at the same times.

The research results included observation and information gathering for 176 individual trail users. Researchers also conducted 75 total in-person surveys. Of these surveys, 10 individuals had never been on the temporary BeltLine trail and 65 individuals had been on the trail. In addition, 12 on-line surveys were completed by individuals as a result of flyers that were distributed to the general public by the research team.

Information was gathered on the baseline level of physical activity of the interviewees based on the standardized International Physical Activity Questionnaire (IPAQ) short form, which is an internationally recognized standard used to collect this type of information. Both the online survey and the in-person survey included the short IPAQ. Flyers advertising the survey were also distributed to the general public. The in-person survey questions were also designed to gather information on other characteristics of the trail users including: residential locational data, commute mode and length, demographic data, usage of the existing temporary beltline trail, most frequently used trail access points, perceptions regarding safety and security along the trail, and activity along the trail.

4.2 Target Populations

The study population includes residents, children (age 12 and over), existing trail users, those who are using parks adjacent to the trail, and members of the general public who were walking or cycling within a one-half mile of the trail corridor or along certain key linkage points which connect the trail to parks and other community facilities located near the trail.

4.3 Survey Results

The following results were obtained from the in-person interviews and user observation counts. A total of 132 observations encompassing 176 individuals were made over five observation days. Observations were conducted on weekdays and Saturdays between August 18, 2011 and September 3, 2011. See Figure 23 for times and results of data collection.

Date	8/18/2011	8/25/2011	8/27/2011	8/31/2011	9/3/2011
Day of Week	Thursday	Thursday	Saturday	Wednesday	Saturday
7:00 AM - 9:00 AM	7	8	12	10	
9:00 AM - 11:00 AM					24
11:00 AM - 1:00 PM		8	30		
2:00 PM - 4:00 PM					18
5:00 PM - 7:00 PM			35	24	

Figure 23: Dates and times of observations collected. Each observation is one group of one or more individuals.

Groups observed ranged in size from one to seven. 101 observations, or 76.5% of the total, were individuals using the trail alone, as shown in Figure 25. Figure 24 shows that males made up 80% of the 176 individuals observed. Groups observed were comprised of males only, females only, or both genders, as shown in Figure 26. Groups of males only and groups of mixed gender were more commonly observed than groups of females only, and males were more likely to travel alone than females.

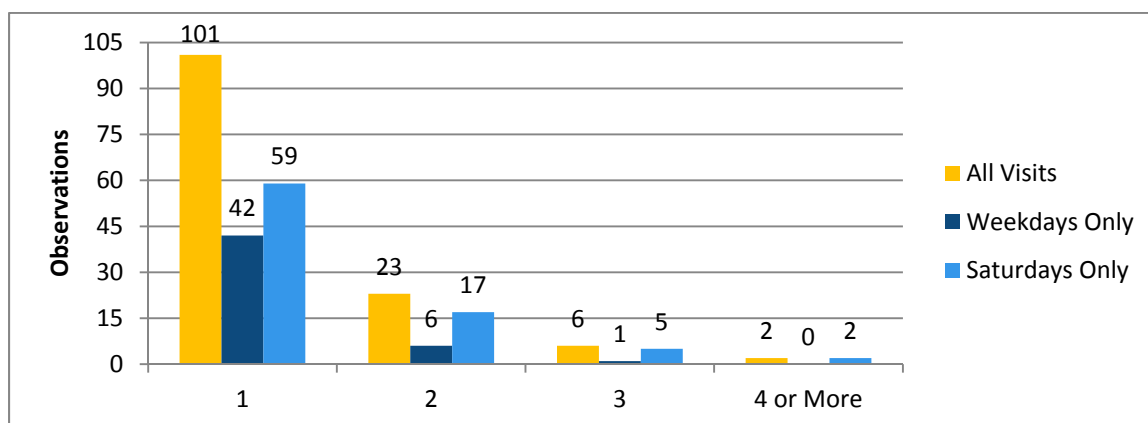
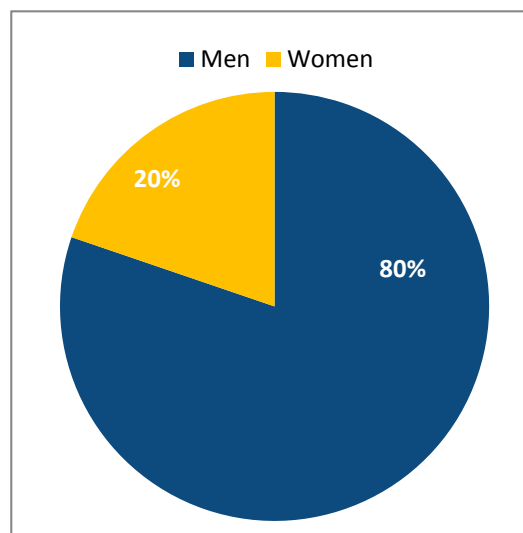


Figure 25: Sizes of groups observed in total, on weekdays only, and on Saturdays only

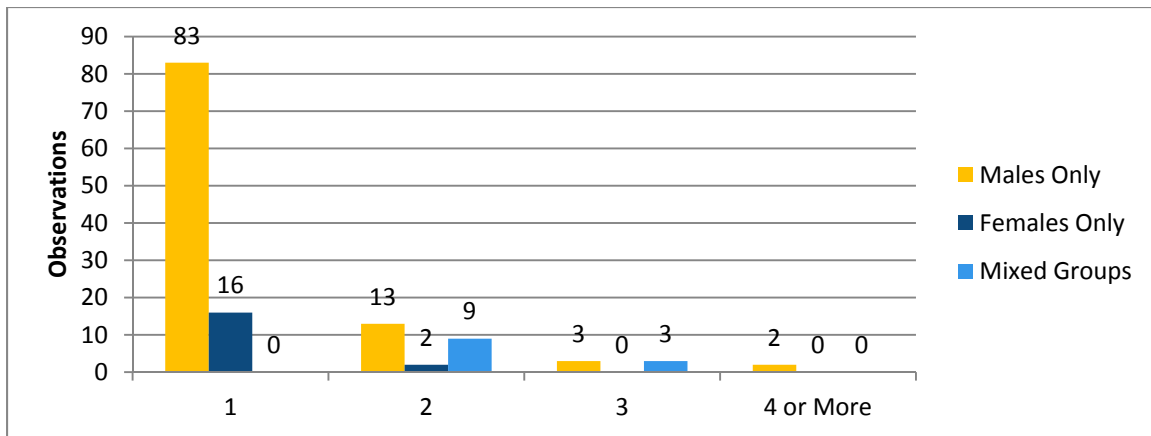


Figure 26: Sizes of groups observed by gender

The individuals that were observed ranged in age from under six to over 66 years. However, the vast majority of individuals observed were over the age of 18. Only 12 of 176 individuals observed were under this age, and trail visitors were most commonly 26 to 45 years old. This was true among both male and female visitors.

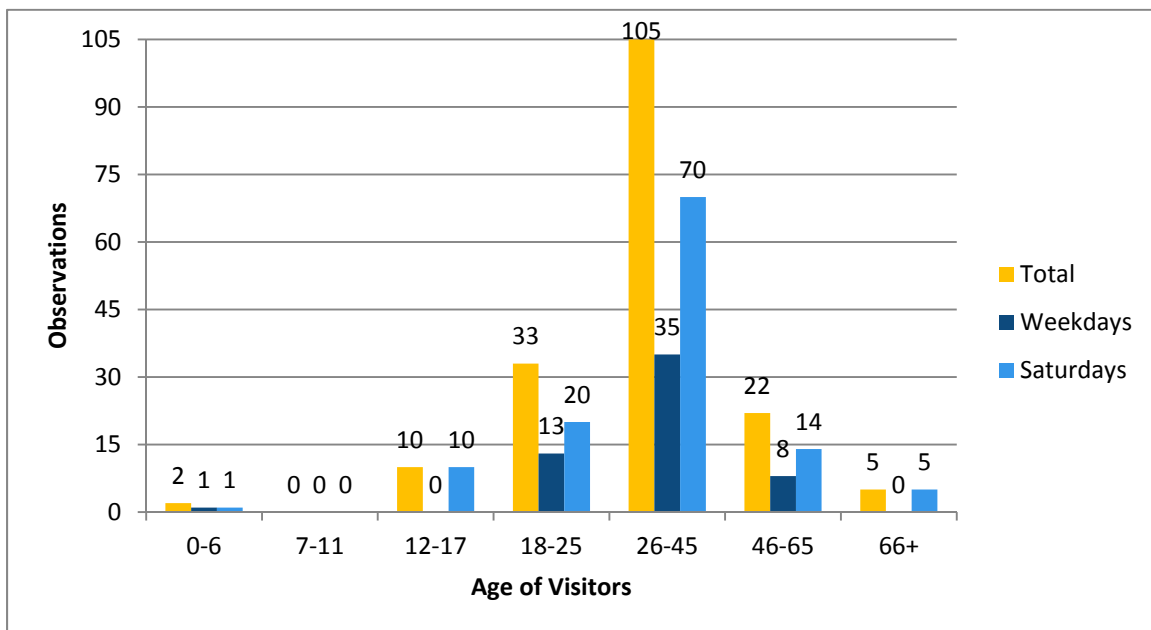


Figure 28 for the full age distribution of visitors, and Figure 27 for age distribution by gender.

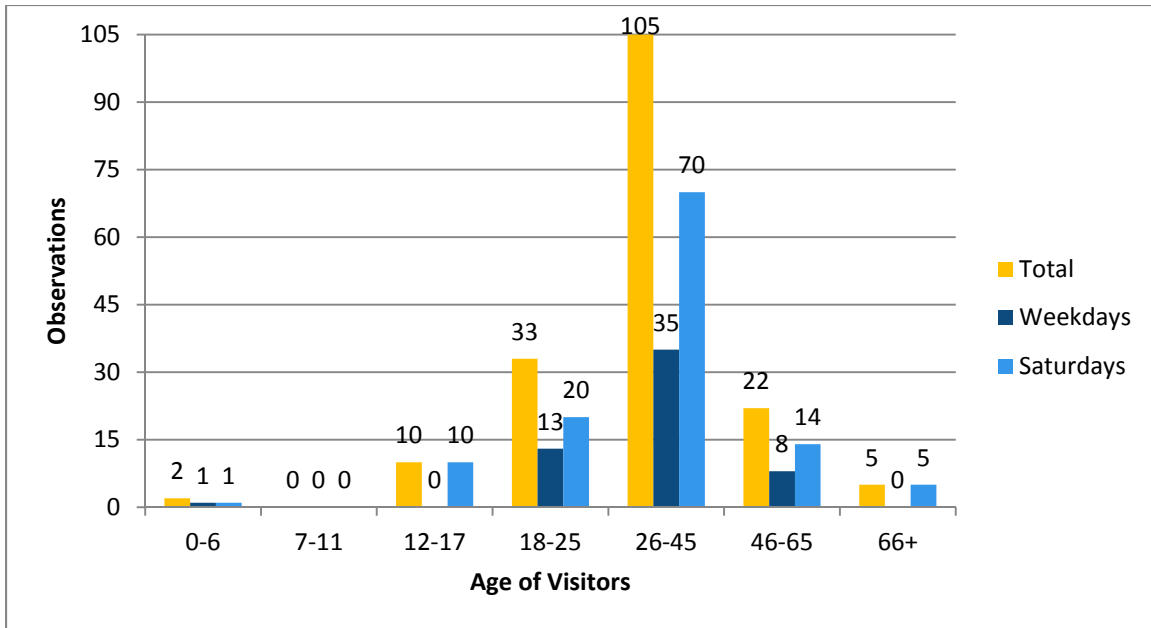
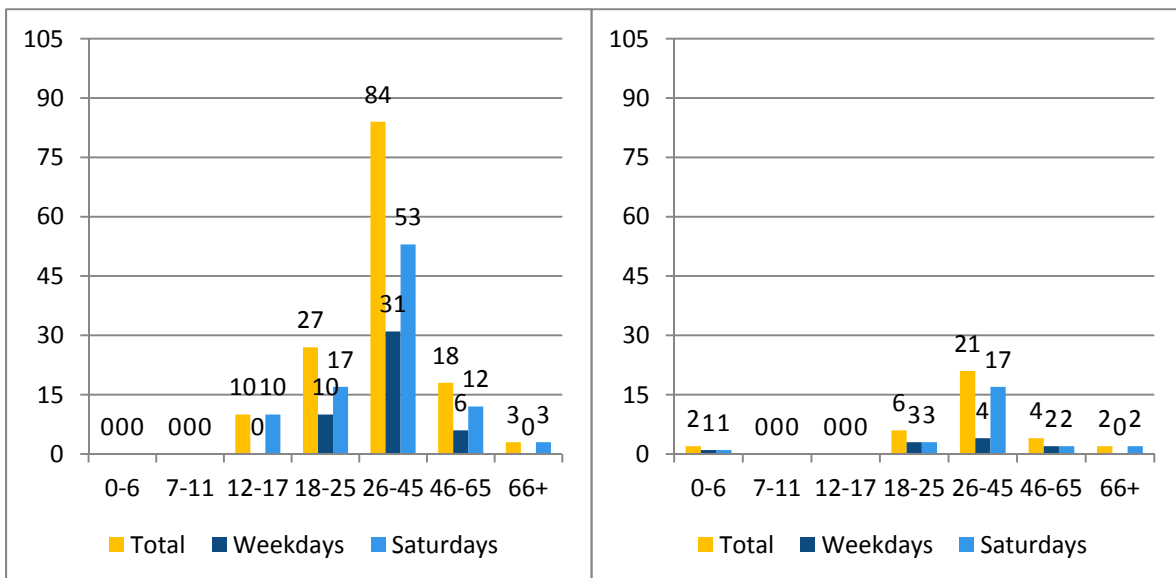


Figure 28: Age distribution of visitors



Visitors were observed at all fourteen access points along the trail. The majority of trail users were observed south of Ralph McGill Boulevard. The Historic 4th Ward Skate Park was the observation access point with the most frequent trail users. Of the 132 observations, 37 included a group entering the trail at this location while 30 included a group exiting the trail at this location. A majority of both entries and exits occurred south of Ralph McGill Boulevard, with Freedom Parkway as the most frequent point of entry and the Historic 4th Ward Skate Park as the most frequent point of exit. See Table 8 below for activity details.

Table 8: Observation frequency by location. Modes are shown in *italics*, except for mixed gender groups, for which no modes existed.

Observation Locations				Entry Points					Exit Points				
	Total	Weekdays	Saturdays		Total	Male	Female	Mixed		Total	Male	Female	Mixed
Location				Location					Location				
Monroe	10	7	3	Monroe	5	5	0	0	Monroe	3	2	0	1
Greenwood	8	2	6	Greenwood	1	1	0	0	Greenwood	0	0	0	0
Urban Body	2	1	1	Urban Body	0	0	0	0	Urban Body	0	0	0	0
Ponce	5	3	2	Ponce	0	0	0	0	Ponce	1	1	0	0
Angier Springs	3	0	3	Angier Springs	1	1	0	0	Angier Springs	0	0	0	0
Ralph McGill	18	9	9	Ralph McGill	1	1	0	0	Ralph McGill	2	1	1	0
Skate Park	29	12	17	Skate Park	0	0	0	0	Skate Park	9	7	1	1
Freedom Pkwy	17	3	14	Freedom Pkwy	10	8	1	1	Freedom Pkwy	4	3	1	0
Parish Restaurant	14	3	11	Parish Restaurant	5	5	0	0	Parish Restaurant	6	2	3	1
Dobbs	4	2	2	Dobbs	6	3	3	0	Dobbs	0	0	0	0
Irwin	11	3	8	Irwin	1	1	0	0	Irwin	1	0	0	1
Edgewood	2	1	1	Edgewood	6	3	2	1	Edgewood	0	0	0	0
DeKalb	6	2	4	DeKalb	0	0	0	0	DeKalb	4	1	2	1
Other	3	1	2	Other	1	1	0	0	Other	0	0	0	0
Total	132	49	83	Total	37	29	6	2	Total	30	17	8	5

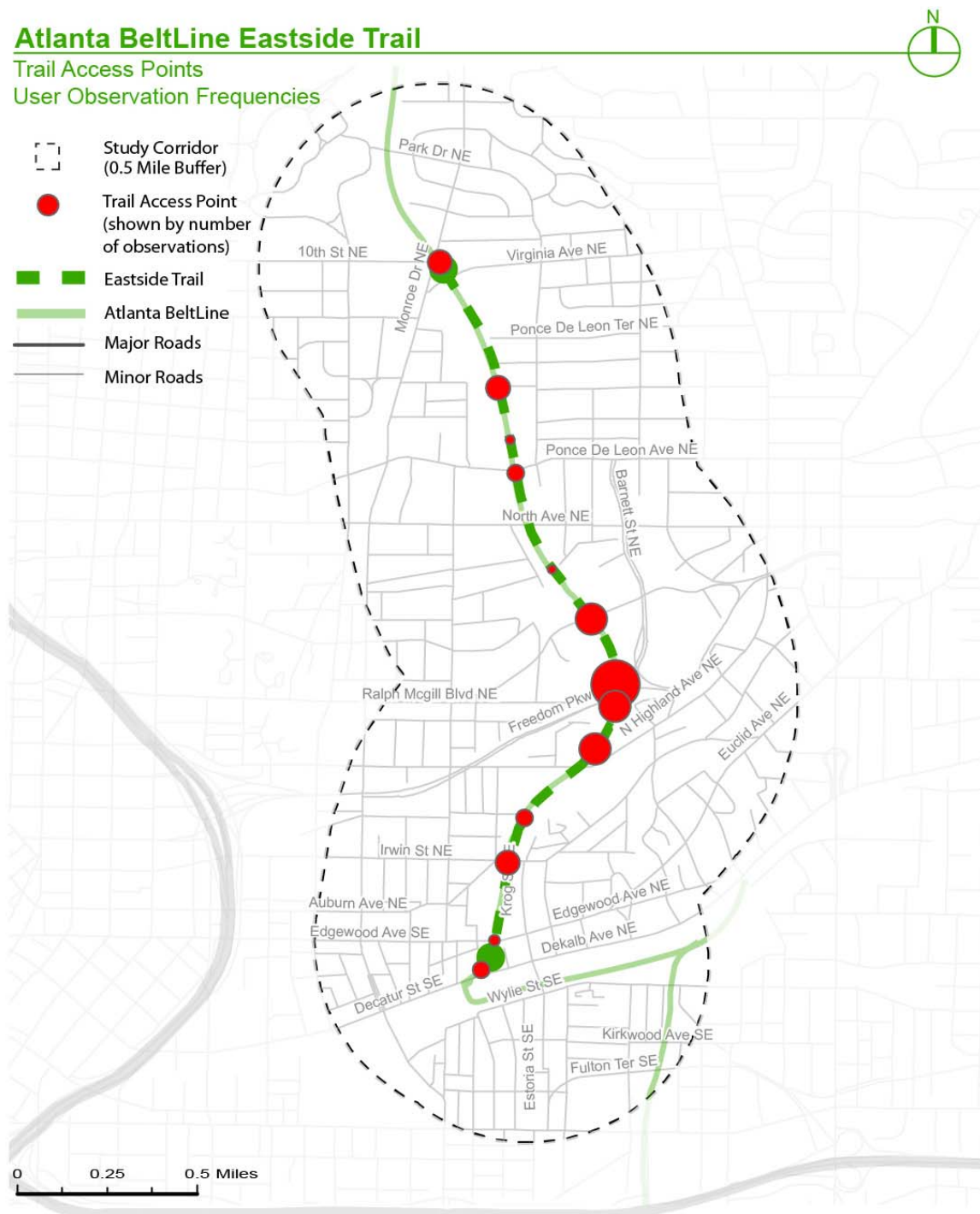


Figure 29: Access point observation frequencies.

Visitors' activities were also observed and recorded. The most common activity observed was walking for leisure, with 51% of individuals engaged in that activity. Other common activities

included running and cycling. Figure 30 shows the frequencies of activity observations. Some visitors were observed with pets. Visitors with pets made up a slightly higher share of observations on weekdays, when they comprised 29% of groups, than on Saturdays, when 24% of groups were observed with pets. Overall, visitors with pets made up 26% of visitors. See Figure 31.

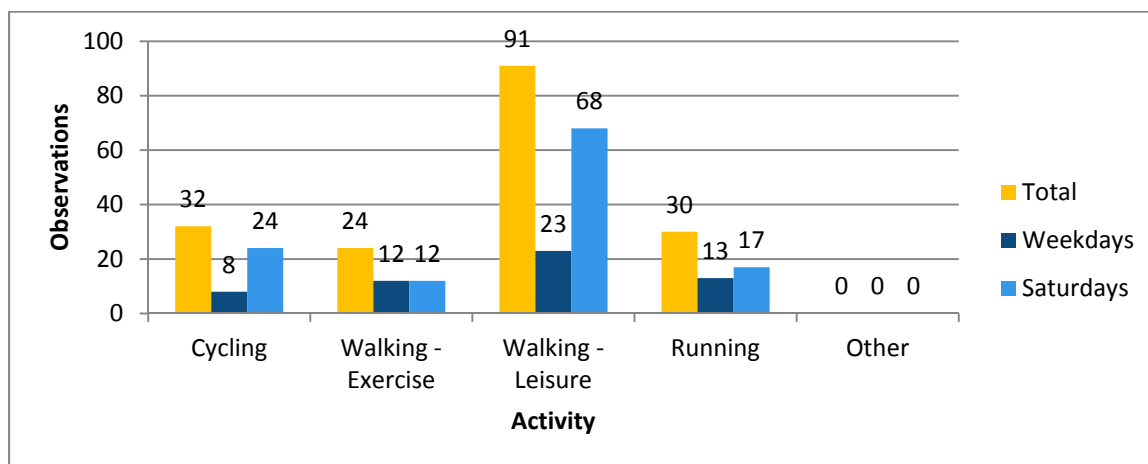


Figure 30: Observed activities of trail visitors.

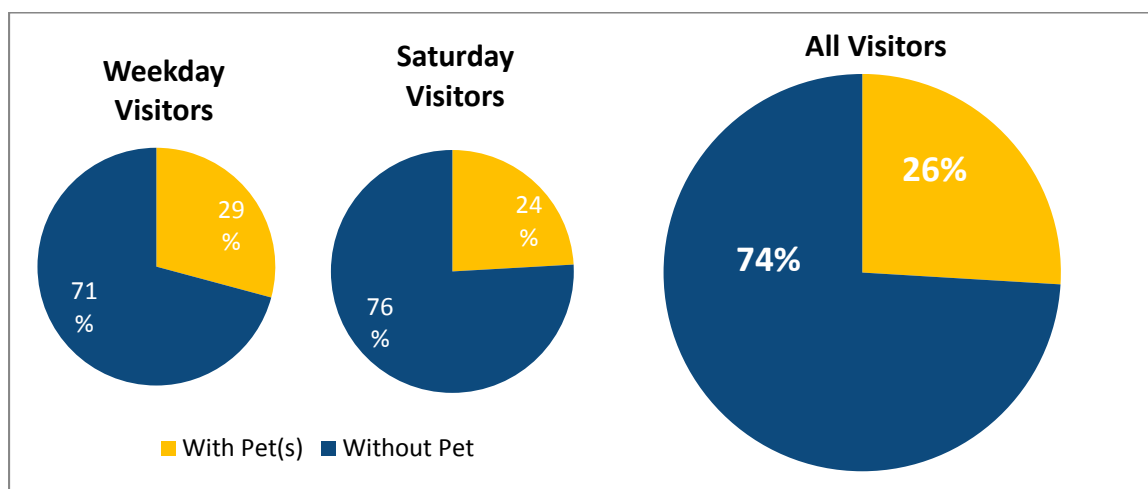


Figure 31: Visitors with pets.

In addition to collecting observation data, 75 surveys were conducted. The survey began with the IPAQ questions regarding an individual's physical activity levels in the previous seven days, including vigorous and moderate activity, walking, and sitting. These data were then compiled into MET minutes per week and categorized as Low, Medium, or High levels of activity according to the IPAQ standards. 69% of respondents reported high levels of physical activity, while 24% reported medium levels, and 7% reported low levels of physical activity (see Figure

32). By gender, male respondents tended to report “high” levels of physical activity more frequently than female respondents, while female respondents reported “medium” physical activity more frequently than male respondents. See Figure 33. These physical activity levels are higher than average reported physical activity scoring for Fulton County and the Atlanta-Marietta-Sandy Springs metropolitan statistical area. According to the CDC, 46.2% of Atlanta area adults reported at least “medium” physical activity levels, while 46.5% of Fulton County adults reported at least “medium” physical activity (BFRSS, see Figure 34).

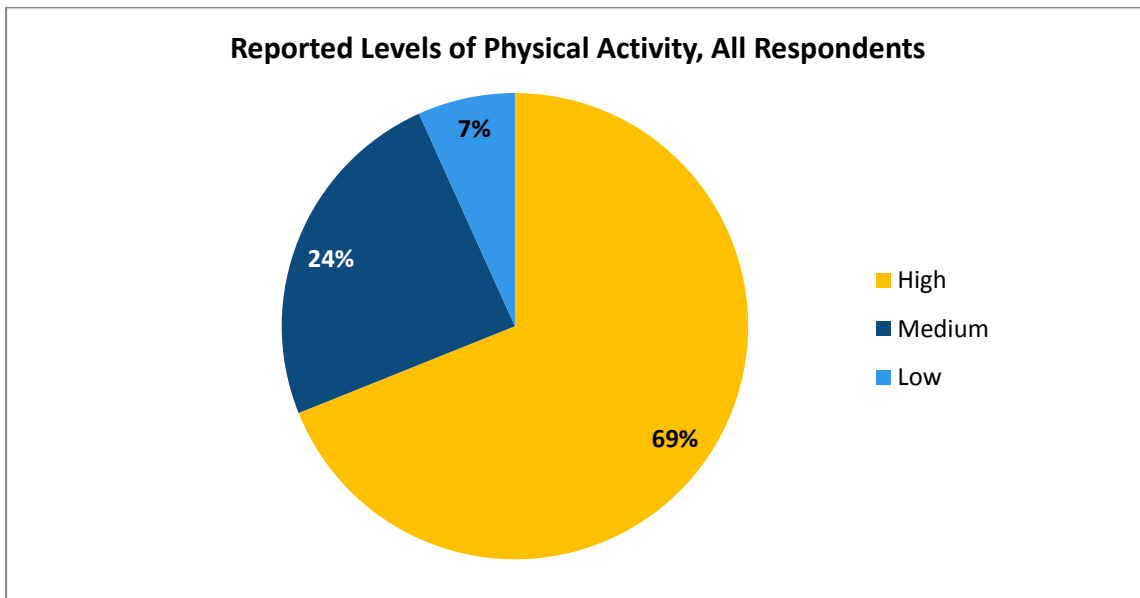


Figure 32: Reported physical activity levels, all respondents

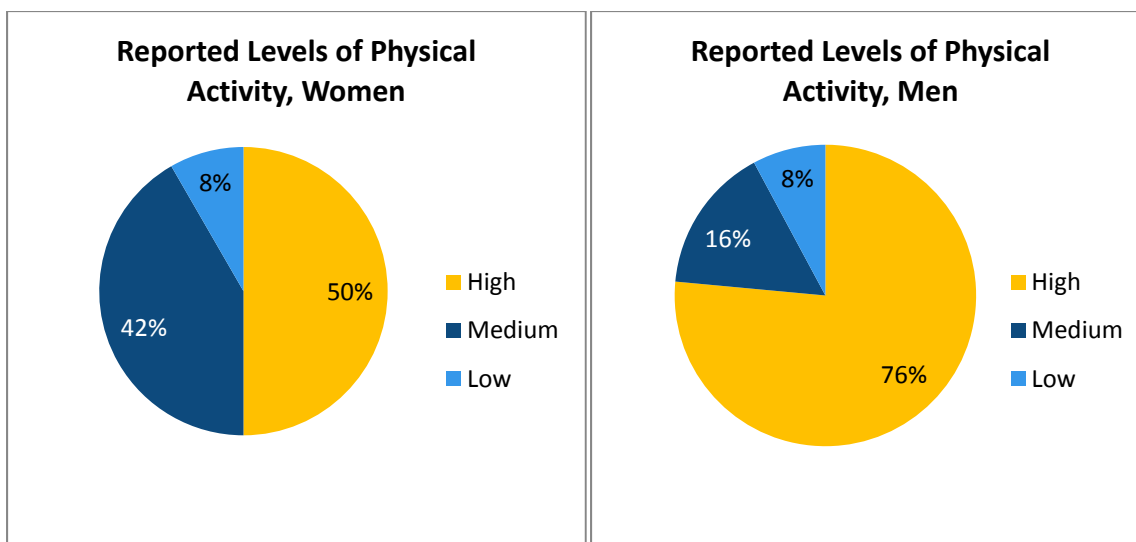


Figure 33: Reported physical activity in female (left) and male respondents.

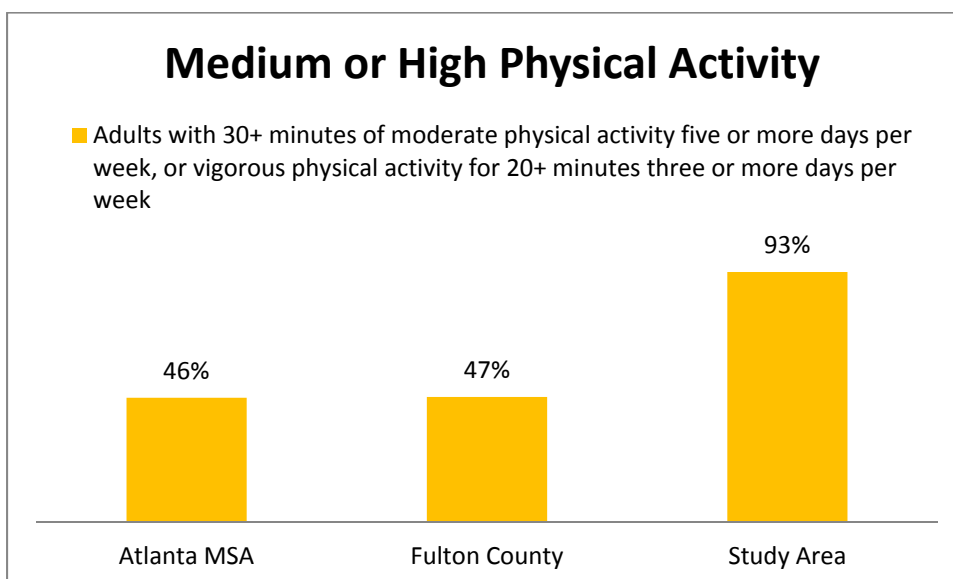


Figure 34: Moderate physical activity in Atlanta MMSA, Fulton County and study area

Following the IPAQ short form a series of questions were asked to gather demographic information for the sample population including the respondent's home and work zip codes, commute length (in minutes), age, and gender. Survey respondents displayed a similar age distribution as observations, with the majority of respondents between the ages of 26 and 45. However, survey respondents were more likely to be female than observed visitors, with females making up 32% of those surveyed. The majority (58%) of respondents reported commuting by

motor vehicle, though a significant proportion (21%) reported commuting on foot or by bike, and 17% reported that they do not have a commute or work from home. See Figure 35.

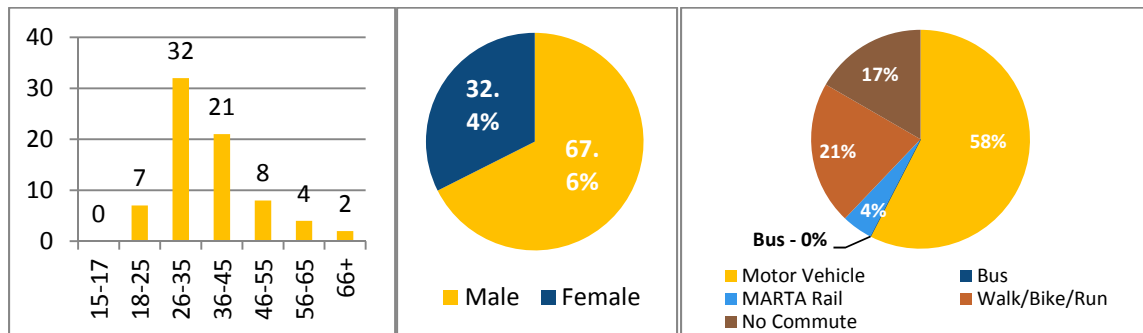
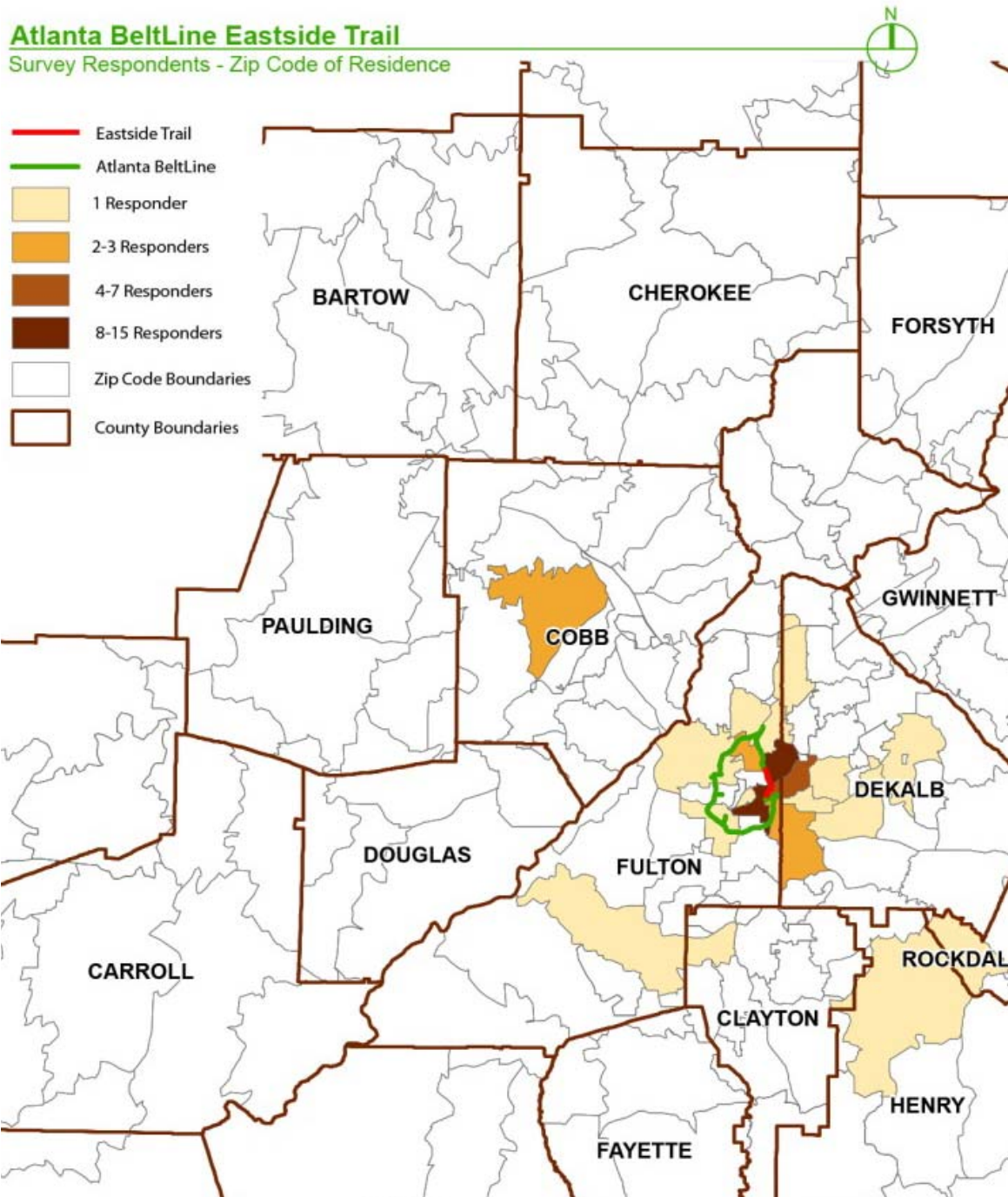
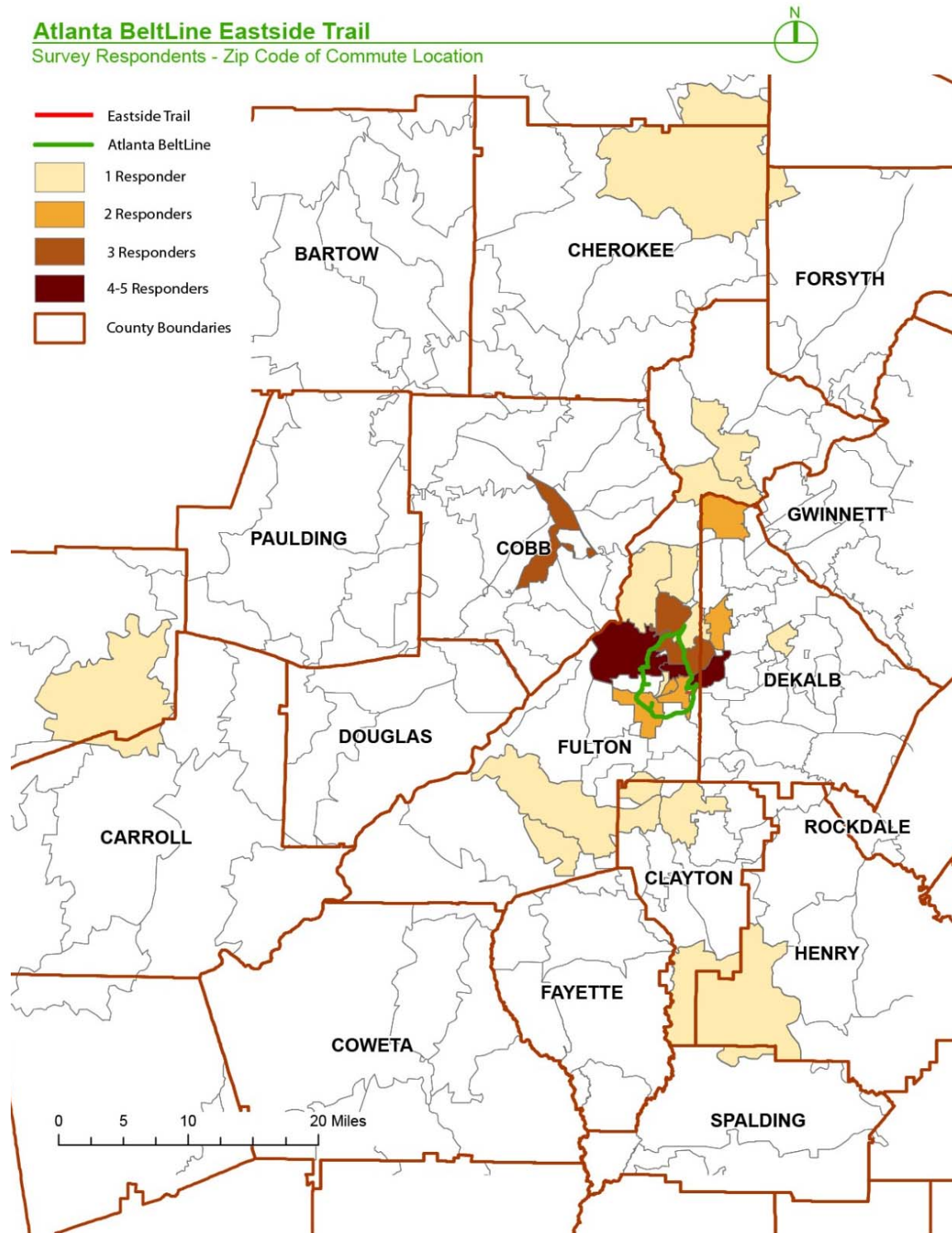


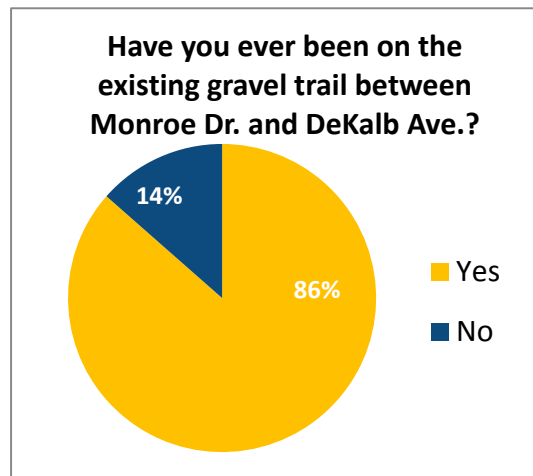
Figure 35: From left: Ages of survey respondents, genders of survey respondents, and commute mode shares.

As previously mentioned, respondents were asked to provide the zip code of their residence as well as the zip code of their commuting destination. This data was utilized by the research team to better understand the commuting patterns of the respondents relative to the location of the Eastside Trail. Figure 36 illustrates the zip codes where the survey respondents live. The responses show that the majority of individuals interviewed live in close proximity to the trail. However, several individuals did travel from adjacent counties. The following Figure 37 illustrates where the most common commuting destinations were located.





The following survey questions measured respondents' use of the existing gravel trail. The first question illustrated to the research team that although the majority of individuals surveyed had used the trail previously, 14% of respondents interviewed at access points near the trail or on the street near the trail had never used the trail. See Figure 38.



Individuals who indicated that they had been on the trail before were then asked a series of questions regarding their use of the trail. A majority of respondents reported using the trail at least once per week, and most respondents reported using the trail on both weekdays and weekends. During each visit, 39% of respondents reported using the trail for less than 30 minutes per visit, while 37% reported using the trail for between 30 minutes and one hour, and 22% reported using the trail for between one and two hours. 2% of respondents reported using the trail for more than two hours at a time. See Figure 39.

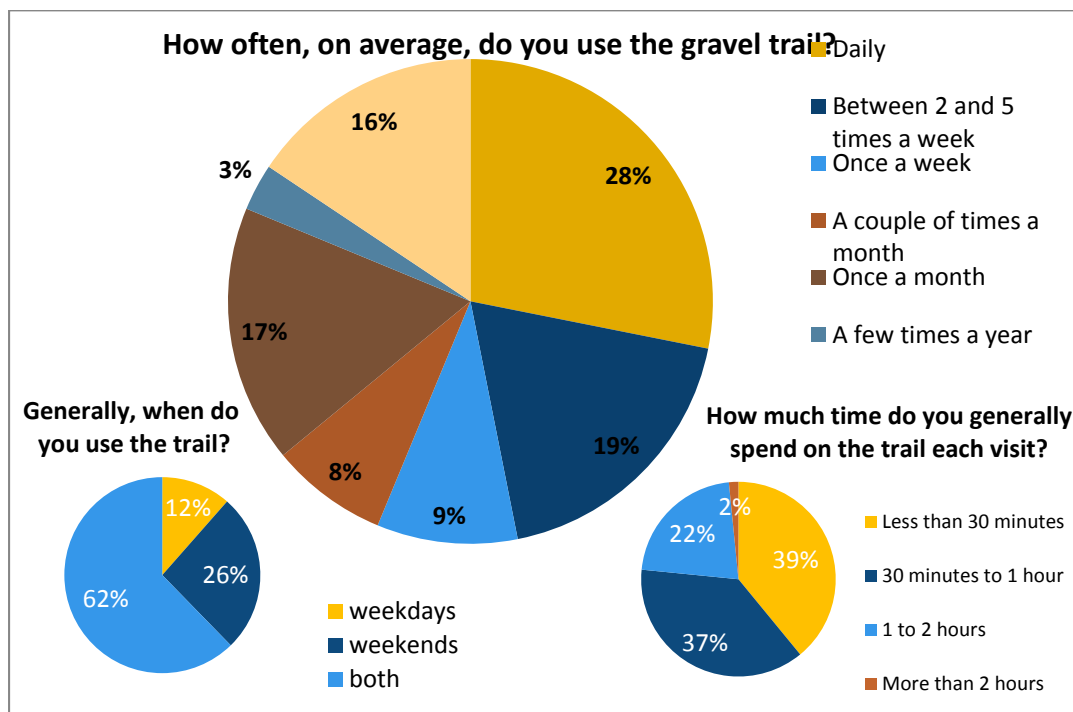


Figure 39: Frequency of trail use.

Next, respondents were asked to describe their activities on the trail. Respondents reported using the trail for walking or hiking for leisure most frequently. Other common activities included running or jogging and walking pets. Respondents most commonly described their use of the trail as recreational, followed by for health and fitness. See Figure 40.

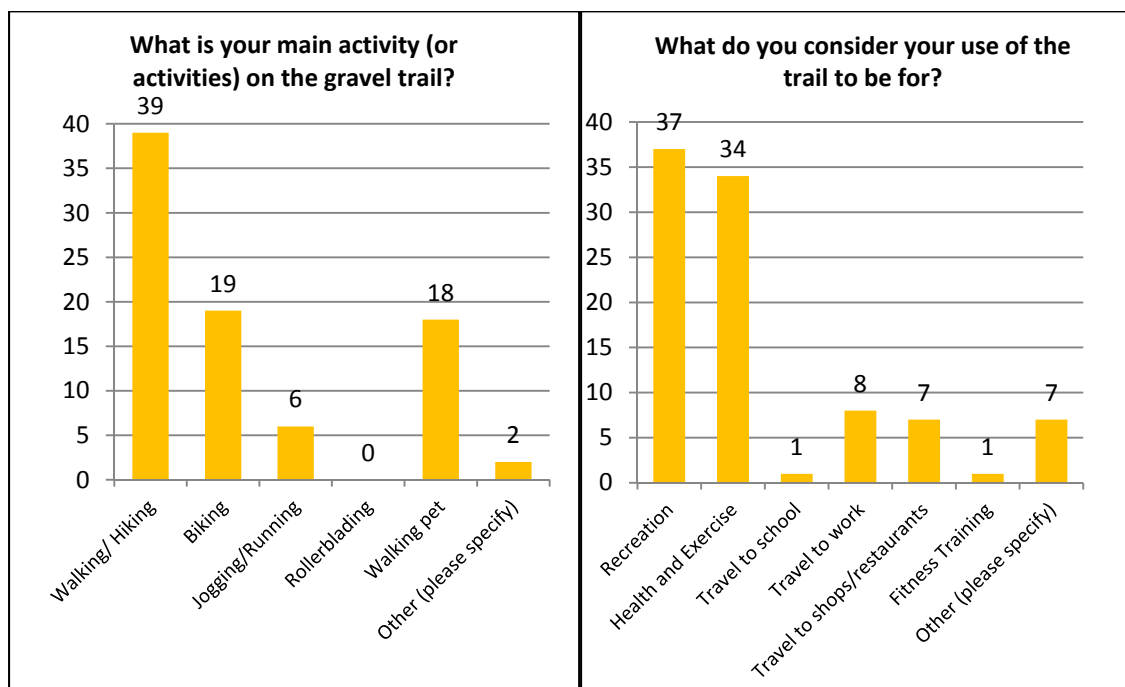


Figure 40: Reported activities and purposes during trail use.

Respondents were also asked which sections of the trail they use and how they access it. Use of each section was relatively evenly distributed, although most respondents reported accessing the trail either at Monroe Drive or south of Ralph McGill Boulevard. The most common trail access points listed by those who were surveyed were Monroe Drive, followed by Irwin Street, the Historic 4th Ward Skate Park, and DeKalb Avenue. See Figure 41.

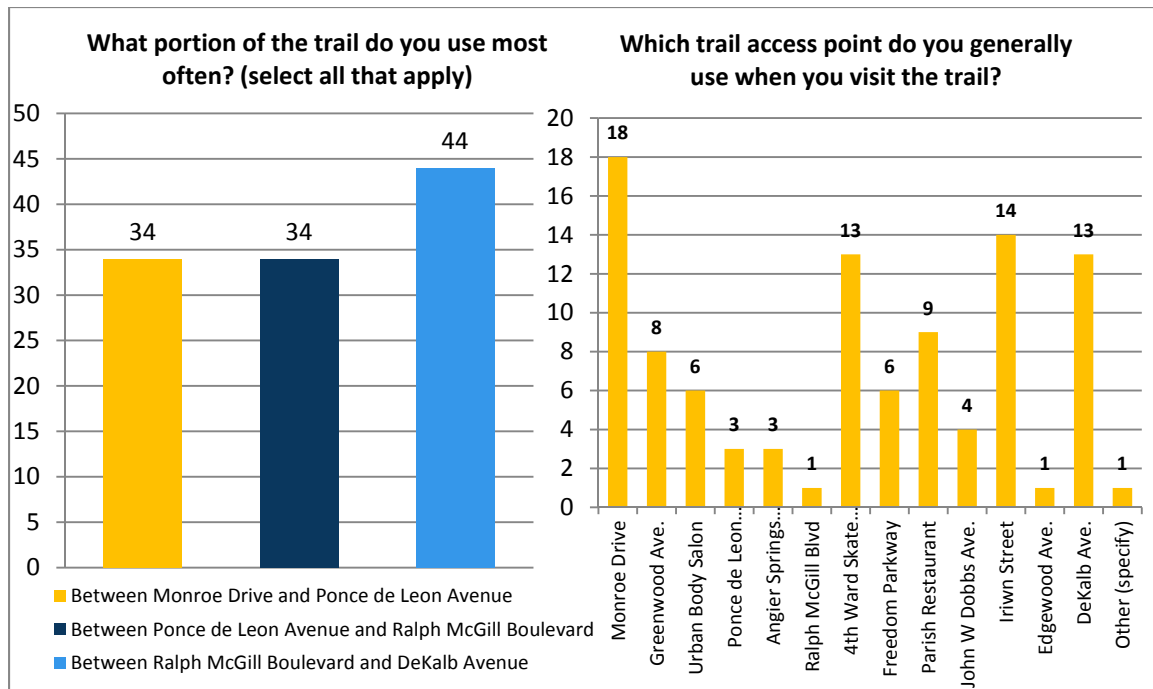


Figure 41: Locations of trail use.

The next questions regarded respondents' perception of the trail's safety and security and the amenities they found along the trail. 53% rated the trail's safety as "Excellent" or "Good" while 16% rated it as "Poor". A substantial number of respondents reported never having made a purchase along the trail. Among respondents who had made a purchase along the trail, the most common purchase was of beverages. See Figure 42.

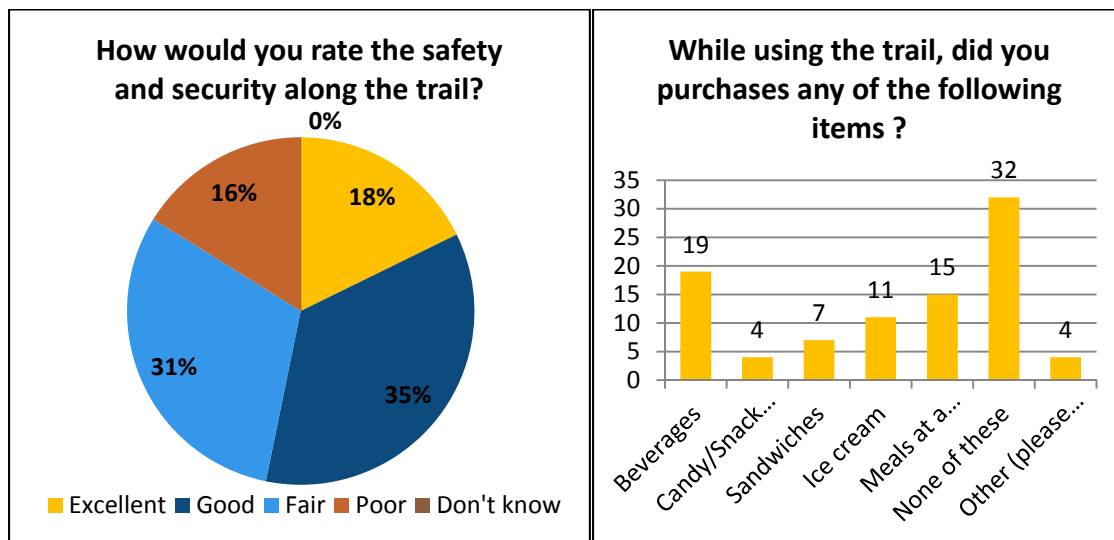


Figure 42: Safety and amenities found on trail.

Last, respondents were asked if they used the trail in their commute. Fewer than one in five respondents reported doing so; among those who do use the trail in their commute, respondents most commonly reported using the section between Ralph McGill Boulevard and DeKalb Avenue. See Figure 43.

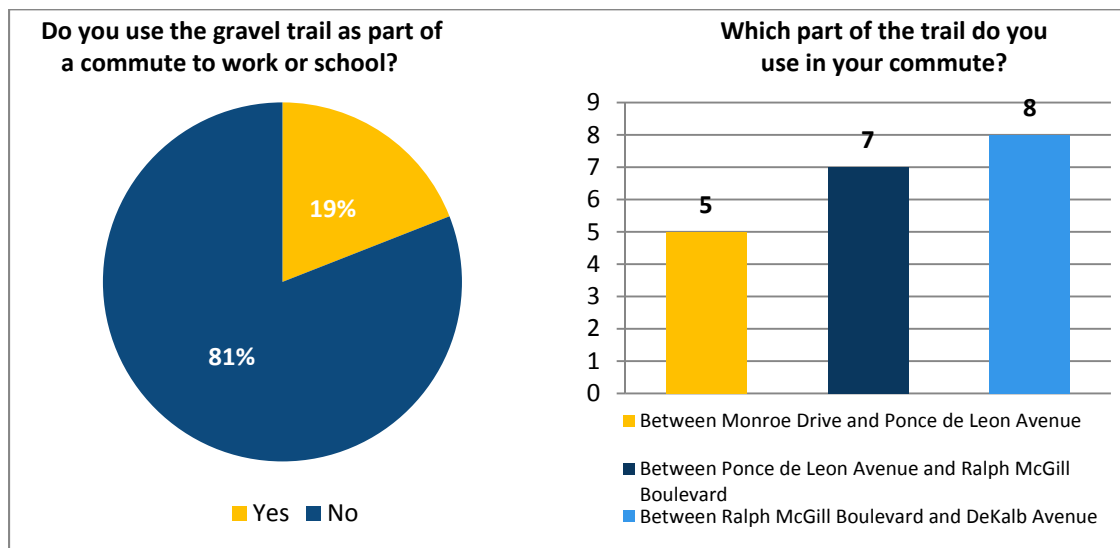


Figure 43: Use of trail in commute.

Survey respondents who reported that they had never been on trail were asked a set of questions about why they had never used the trail. Respondents indicated a variety of issues preventing them from using the trail, including lack of knowledge, distance, and preference for exercising in other ways. See Figure 44.

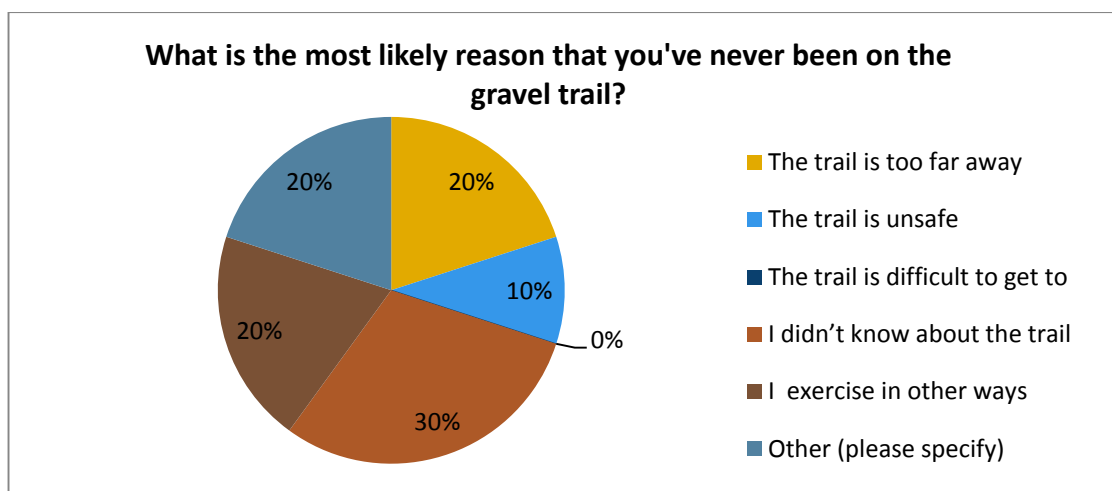


Figure 44: Reasons preventing respondents from using the trail.

Respondents were also asked if they would consider using the trail in the future, after it is paved. All respondents indicated that they would definitely or maybe use the trail in the future. Common reasons for using the trail included recreation and health and exercise. See Figure 45.

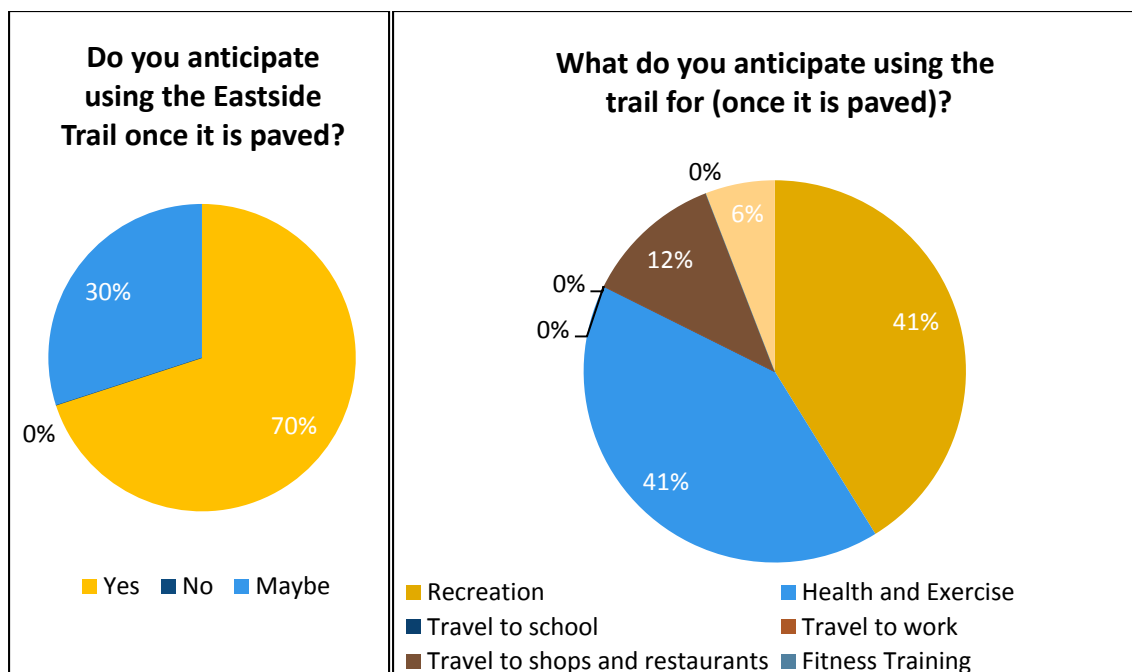


Figure 45: Anticipated future use of trail for respondents who had not previously used it.

One final question was asked of all respondents, including both previously trail users and those who had never used it, inquiring how respondents had initially discovered the trail. The most common answers included “word of mouth” and “driving, biking, or walking past.” See Figure 46.

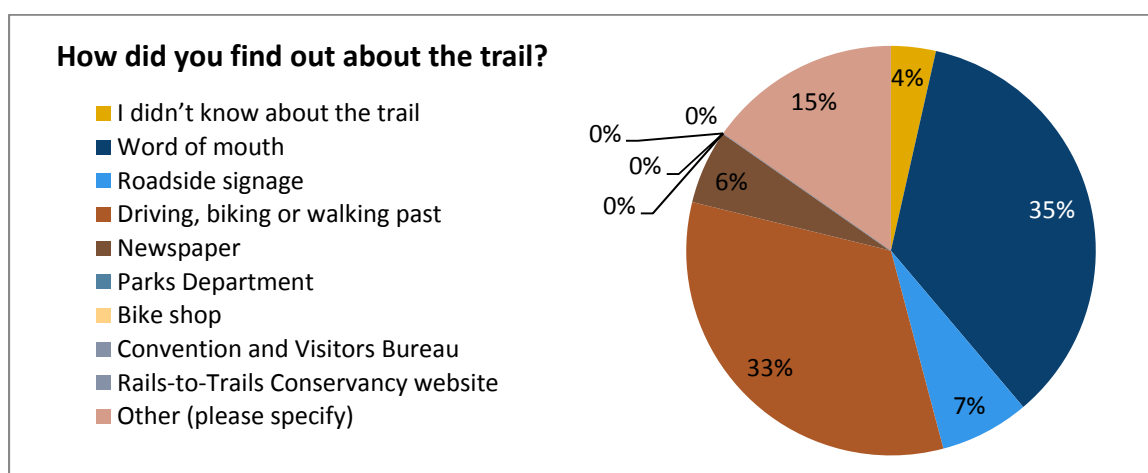


Figure 46: How survey respondents found out about the Eastside Trail.

In addition to surveys conducted in person on- and off-trail, some individuals followed a link to an online survey. Of the 12 online surveys completed, most indicated that they were given the link by Georgia Tech researchers while they were on the trail and unable to complete a survey in person. However, two individuals indicated that they were directed to the survey by someone else. See Figure 47. Respondents answered the same set of questions asked of the in person survey, with the following results.

Similarly to in-person survey respondents, online survey respondents indicated a high level of activity in their everyday life, with a majority scoring “high” on the IPAQ. Only 8% of respondents scored “low” on this scale. See Figure 48.

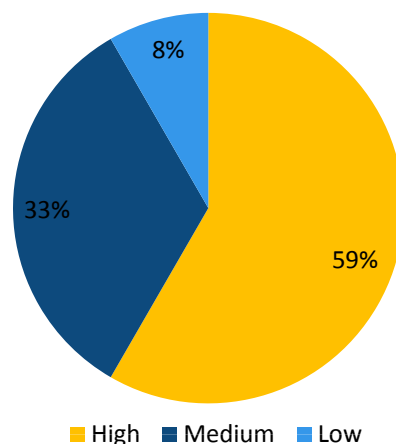
Demographic questions revealed the respondent’s home and work ZIP codes, commute, age, and gender. Survey respondents displayed a similar age distribution as other surveys and observations. As with the in-person surveys, respondents were more likely to be female than were observed visitors. Most respondents commute by motor vehicle. See Figure 49.

How did you hear about this survey?



Figure 47: Source of online survey respondents.

Reported Levels of Physical Activity, All Respondents



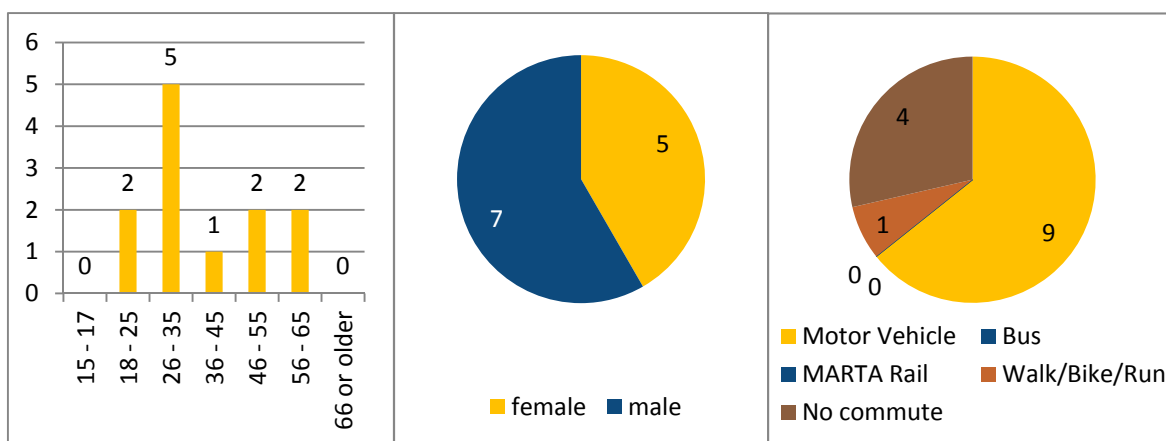
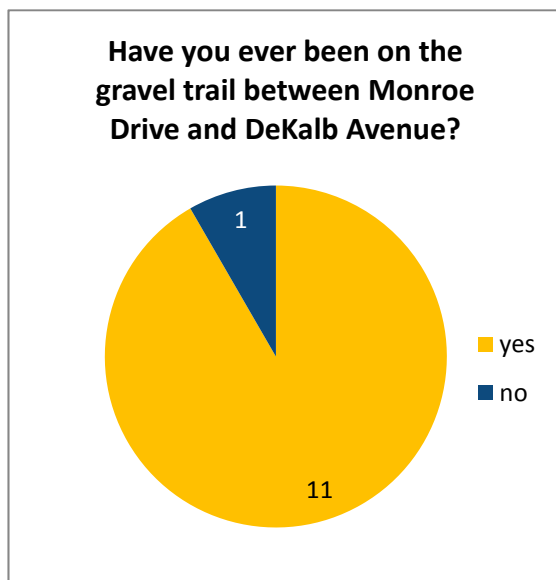


Figure 49: From left, age distribution, genders, and commute mode of online survey respondents.

All but one of the online survey respondents indicated that they had previously been on the Eastside Trail. See Figure 51. Half of respondents indicated that they use the trail at least one



time per week. However, these respondents use the trail for shorter duration than respondents to the in-person survey, with 82% indicating that they use the trail for less than one hour per visit. See Figure 52. These respondents most frequently reported that they use the trail only on the weekends. See Figure 50.

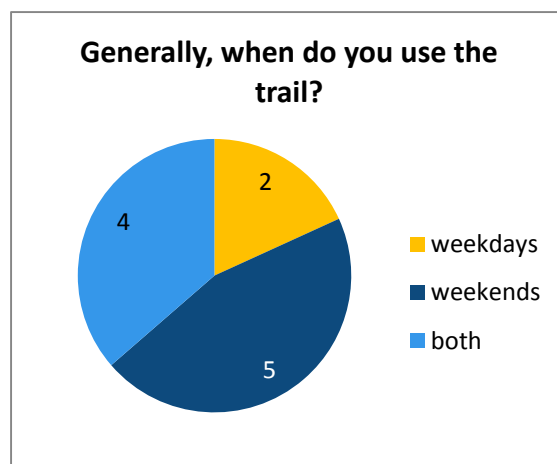


Figure 50: Days of trail use.

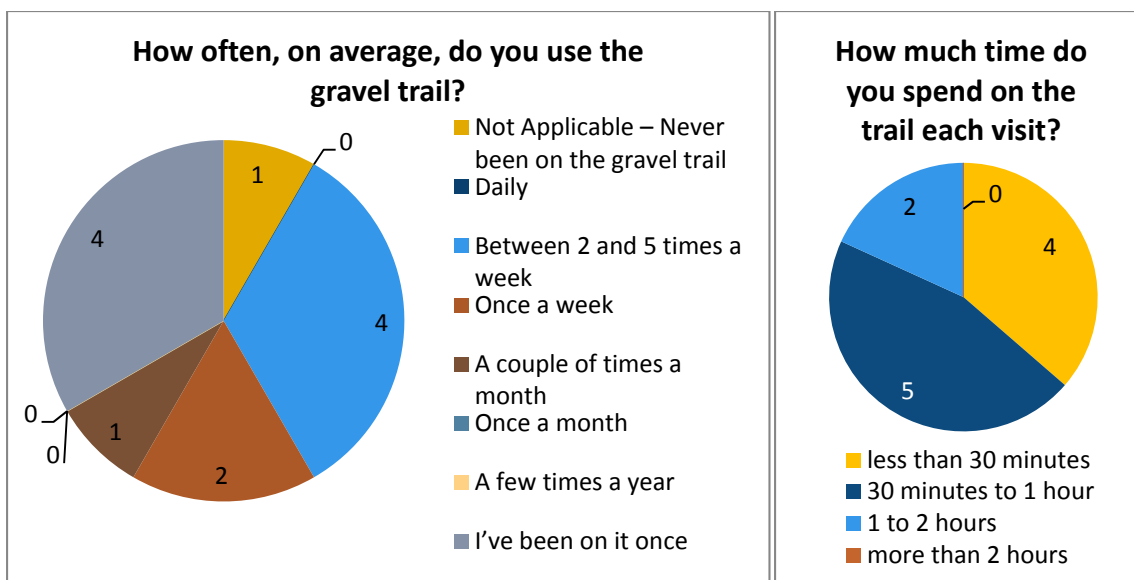


Figure 52: Frequency and duration of trail use of online survey respondents.

Regarding activities on the trail, online survey respondents indicated that they most frequently engaged in walking or hiking, with running or jogging second most frequent. In accordance with this, respondents most frequently indicated that they considered their purposes on the trail to be recreation or health and exercise. See Figure 53.

55% of online survey respondents rated the trail's safety and security as "Excellent" or "Good", while 9% rated it as "Poor". As with in-person survey respondents, online survey respondents most frequently reported that they had never purchased items along the trail. Of

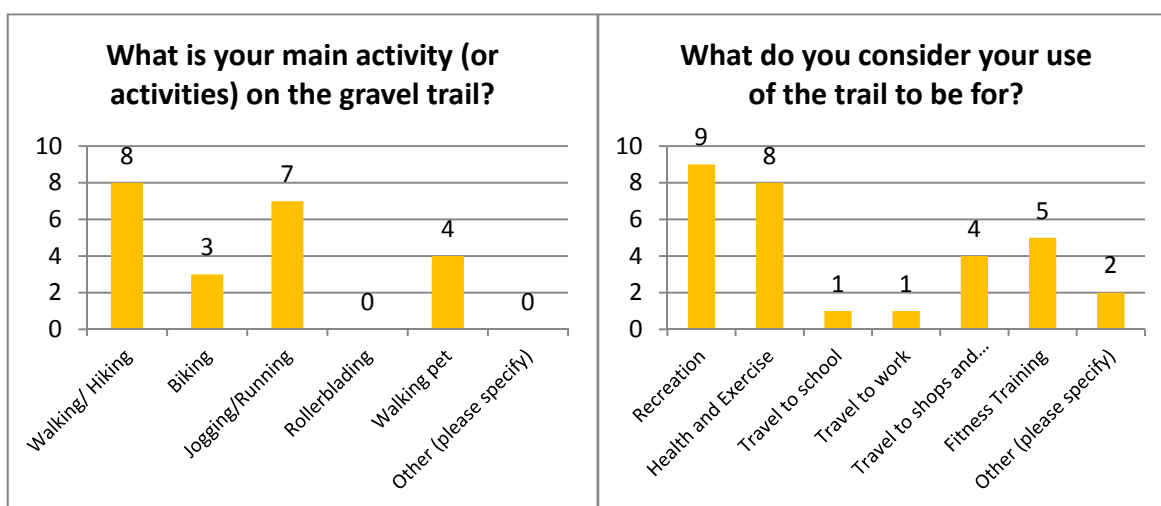


Figure 53: Activities and purposes of online survey respondents.

those who had, beverages were the most common type of item purchased along the trail. See Figure 55. 18% of respondents reported using the trail as part of a commute to work or school, with sections of the trail used in commute being evenly distributed. See Figure 56.

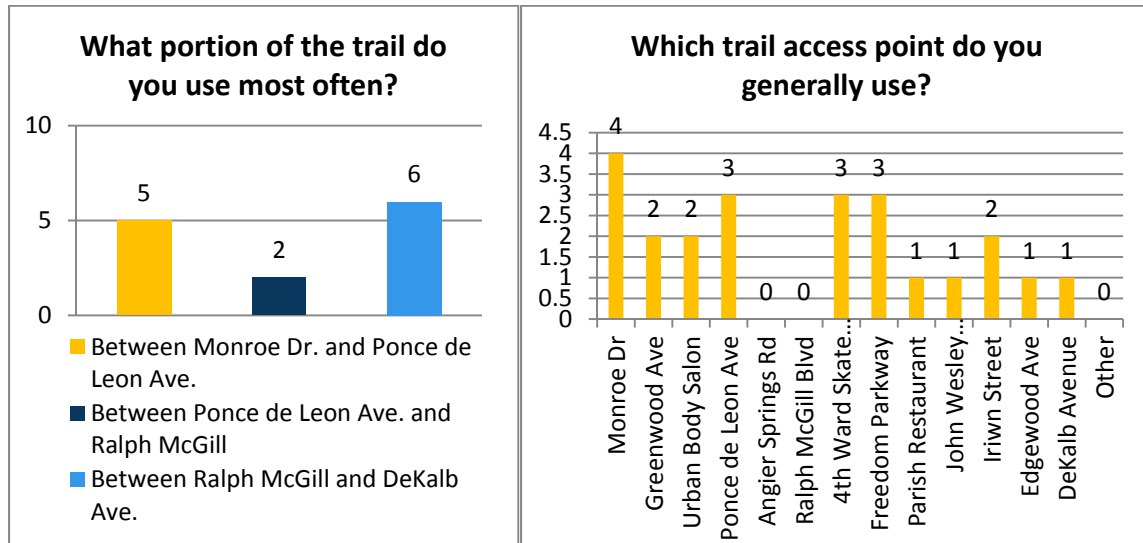


Figure 54: Portions of trail used by online survey respondents.

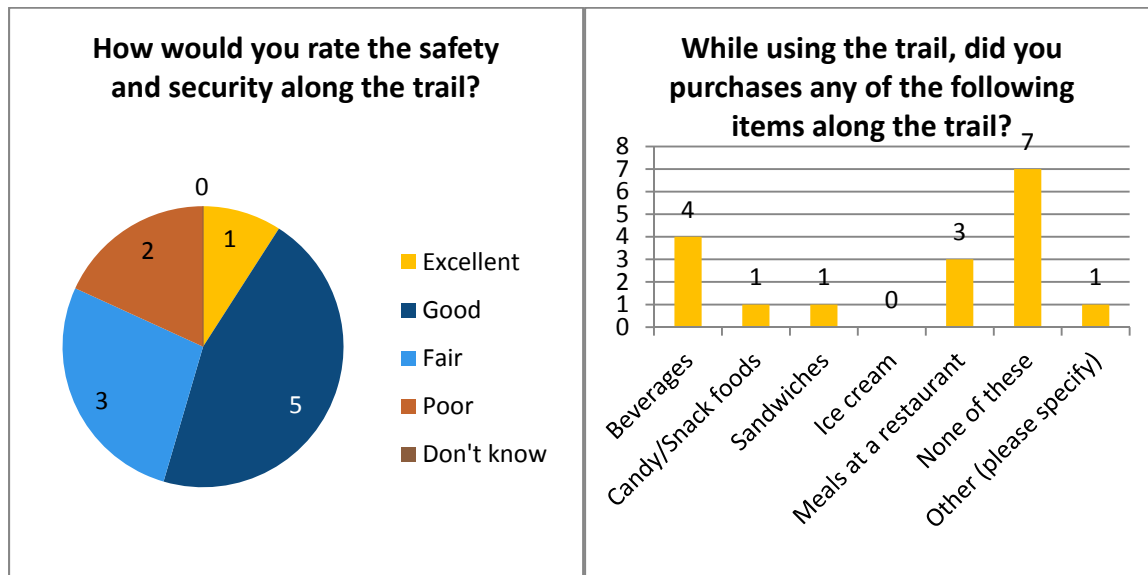


Figure 55: Safety and amenities along the trail.

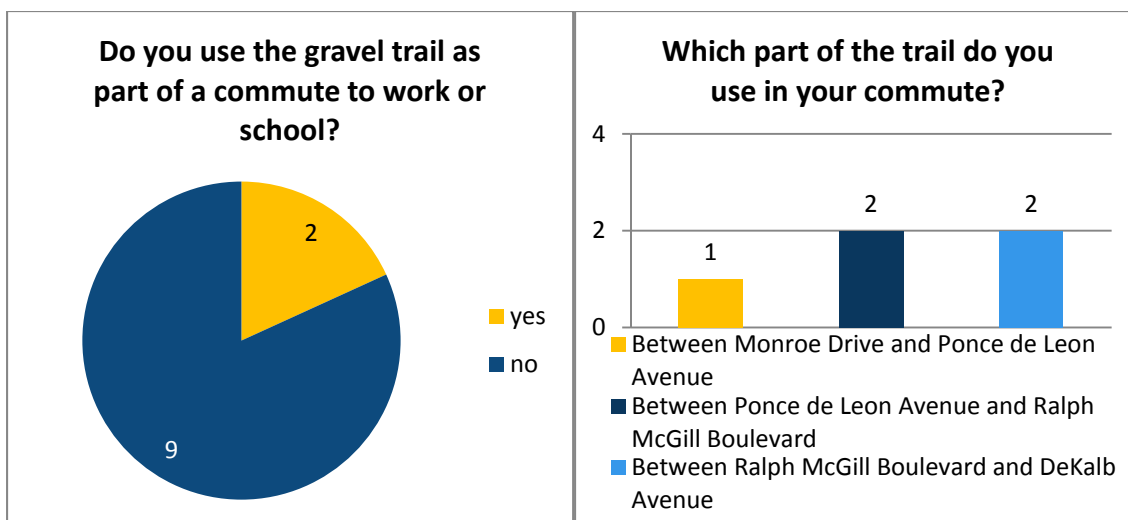


Figure 56: Use of the trail in commutes to work or school.

A single online survey respondent had never used the Eastside Trail. This respondent indicated that he or she had never used the trail due to having “no reason to”. He or she would consider using the trail once it is complete, most likely for the purpose of health and recreation.

Online survey respondents indicated a number of sources from which they had heard about the Eastside Trail. The most common answers included “Word of mouth” and “Driving, biking, or walking past.” See Figure 57. Several respondents indicated that they live near the trail.



Figure 57: How online survey respondents found out about the trail.

Overall, the results of user observations and surveys have been compared to the demographic characteristics of the surrounding population. The results of this comparison indicate that those individuals interviewed and observed on the trail have a higher physical activity level than the surrounding population and are more likely to be male.

5. Forecasting BeltLine Access

5.1 Latent Demand Score

Changes to the built environment result in changes to the travel behavior of the surrounding population. If a facility such as the BeltLine Eastside Trail is built, which accommodates and encourages active modes of travel (biking and walking), then the likelihood increases that the surrounding population will begin to use these modes as a viable travel option. The potential or probability for the surrounding population to use these active travel modes to reach major destinations, or attractors, can be predicted by calculating the latent demand score (LDS) for the study area corridor. The research for this study includes an analysis of the probability that the surrounding population will use active travel modes (walking and biking) to reach major destination points in the study area corridor. This research also measures the impact of the construction of the new transportation facility, the BeltLine Eastside trail, relative to the context in which the trail is located and how this new facility will impact rates of active travel modes.

To conduct this analysis, researchers first created an inventory of the physical and built environment within the study area corridor, (defined as a 0.5 mile buffer along either side of the trail). The existence of major destinations, the connectivity of the street network, and distance from the trip origin (usually an individual's place of residence), among other factors all influence the feasibility, accessibility, and desirability of the use of active modes of transportation. These factors are all utilized as inputs in the LDS calculation. This information can then be used in a standard demand forecasting technique to measure potential demand for alternative modes of transportation, specifically bicycling and walking. This method of forecasting demand is determined by calculating the Latent Demand Score (LDS) on the existing road network for the study area corridor.ⁱ This analysis will include an estimate of potential demand for bicycle and pedestrian travel based on certain area demographics; the magnitude, frequency, and proximity

ⁱ The LDS methodology was devised by Bruce Landis of Sprinkle Consulting.

of bicycle and pedestrian trip generators, as well as other land use characteristics such as residential density.

The LDS provides an estimate of potential demand for non-motorized travel throughout the transportation network. For the BeltLine Eastside Trail, the LDS was customized so that it could be used to analyze potential pedestrian demand as well as bicycle demand. This analysis provides results that allow decision makers to compare the demand for bike and pedestrian trips on each road segment of the primary transportation network in the area adjacent to the Eastside Trail.

5.2 Methodology

The calculation of the LDS is a GIS-based analysis that identifies trip destinations or attractors within the study area corridor and the probability that an individual will walk or bike various distances to reach one of these attractors. In order to calculate these values, the LDS uses a gravity model designed to rank road segments based on their proximity to different types of major attractors and the probability that someone will walk or bike a certain distance to those different types of attractors. **Figure 58** shows an example of the equation used in calculating LDS for an individual road segment.

$$LDS = \sum_{n=1}^4 \left[TTS_n \times \frac{\sum_{n=1}^4 (GA_n \times \overline{TG}_n)}{(\sum_{n=1}^4 GA_n \times \overline{TG}_n)} \times \left[\overline{TG}_n \times \sum_{d=1}^l P_{nd} \times ga_n \right] \right]$$

Where: n = bicycle trip purpose (e.g., work, personal/business, recreation, school)
 TTS = trip purpose share of all bicycle trips (obtained from Census data)
 GA = number of generators or attractors per trip purpose
 TG = average trip generation of attractor or generator
 P = effect of travel distance on bike trip interchange, expresses as a probability

Figure 58. LDS Equation

Source: Shawn Turner, P.E.; Aaron Hottenstein, Gordon Shunk, P.E. 1997. *Bicycle And Pedestrian Travel Demand Forecasting: Literature Review*, Research Report 1723-1, Research Study Number 0-1723, Texas Transportation Institute, College Station, TX. Available online at <http://tti.tamu.edu/documents/1723-1.pdf>.^{ii iii}

The number of trips generated by the major attractors was determined using the Trip Generation 5 software. The software utilizes average trip generation rates from Institute of Transportation Engineers' *Trip Generation Manual* (6th Edition, 2003) to calculate the number of weekday trips produced by different land uses. These trip generation rates represent the decision to travel for a given purpose. The trip generation rates used in the analysis include PM peak hour weekday rates. Attractors were categorized based on land use as one of the following: parks, elementary school, middle school, high school, library, recreation centers, employment locations, or retail locations. For each attractor, trip generation rates were used to determine the number of weekday (24-hour period) two-way trips. An average number of trips was then calculated for each land use. For example, four schools - were considered major attractors. The number of trips that each one of these individual schools generated was calculated (see Table 9 for variables to determine trip generation). The average of these three values was calculated to estimate that a typical school located in the study area corridor along the BeltLine Eastside Trail would generate 492 weekday trips. After the estimated weekday trips were calculated for each type of land use, the attractors were divided into the more broad categories of school, recreation, and a mixed use (includes work and shopping clusters) to simplify the data for use in the model.

Based on the LDS methodology and review of existing conditions data obtained from the City of Atlanta and Fulton County the following destinations (or attractors) were identified:

- The following schools are located in the study area: Hope Elementary School (public), Inman Middle School (public), Grady High School (public) and The Children's School (private elementary and middle school)

ⁱⁱ For the BeltLine Eastside Trail analysis, the calculation of TTS used trip purpose data obtained from the Georgia Tech SMARTRAQ travel survey of the 13-County Atlanta Metropolitan Area in place of Census data.

ⁱⁱⁱ The LDS methodology is typically applied to bicycle trips, but has been adapted for the BeltLine Eastside Trail to estimate demand for walking trips as well.

- Parks that are wholly or partially located in the study area including: Piedmont Park, Orme Park, John Howell Memorial Park, Freedom Park, Morgan Boulevard Park, Parkway-Merritts Park, Springvale Park, Esther Peachey Lefever Park, Cabbagetown Park
- Recreation Centers that are located wholly or partially within a 0.5 mile distance of the trail in the study area including: J.D. Sims Recreation Center, Bass Recreation Center, Lang-Carson Recreation Center, and MLK Community Center
- One library is located within 0.5 miles of the trail

Based on the analysis of commercially available employment count data as well as zoning designation, land use, and parcel boundary data provided by the City of Atlanta, the following eight mixed use (shopping and employment) activity nodes were identified to be located in the 0.5 mile study area. These areas include both commercial and retail establishments:

- The intersection of Boulevard and North Highland Avenue
- The intersection of Krog Street and Lake Avenue
- The intersection of Ralph McGill and the BeltLine Eastside Trail
- The segment of Ponce DeLeon Avenue between City Hall East and the adjacent shopping center
- Along Ponce De Leon Avenue east of the intersection with Ponce De Leon Place
- The intersection of 8th Street and Monroe Drive
- The intersection of Ponce De Leon Avenue and Ponce De Leon Place
- The intersection of Memorial Drive and Cameron Street

The areas are included as attractors in the LDS analysis if they draw 300 or more individual employees to the cluster. A visual assessment of potential attractor clusters was first conducted using GIS analysis of employment and land use data. All potential attractor were included in this initial inventory. Buffers were then created using a 400 foot radius to assess the number of employment points located in close proximity to each other (this included both retail and office destination points).

Table 9 identifies the specific types of attractors, groups them into more general trip attractor types, identifies the land use category as defined by the trip generation software, illustrates the variables used to calculate estimated number of trips, and provides the estimated number of trips per attractor by land use category for the BeltLine Eastside Trail.

Table 9: Summary of Inputs for Trip Generation 5 Software

Attractor	Trip Attractor Type	Trip Generation 5 Land Use	Variable	Average Estimated Trips per Weekday per Attractor
Park	Park/Recreation	City Park	Acres	398
Recreation Center		Recreation Community Center	gross square footage of the facility/1,000	
Library	Park/Recreation	Library	gross square footage of the facility/1,000	
Elementary School	School	School	Students	492
Middle School				
High School				
Employment Center	Employment	Business Park	Employees	128
	Shopping	Specialty Retail Center	Employees	406

Note: Employment centers considered both business park and specialty retail land uses based on the actual percentage mix of retail and business uses at the center. This mix was determined using 2006 BusinessPoint™ employment data from Claritas, a company that provides marketing research demographic data, marketing software and market segmentation services (<http://www.claritas.com>).

To conduct the LDS analysis, the probability of a trip to a particular attractor occurring by biking or walking was determined using data from the 2002 SMARTRAQ survey. SMARTRAQ is a

transportation and land use project that was conducted jointly by Georgia Tech Research Institute and the Bombardier Active Transport Research Lab at University of British Columbia. The survey was a component of this project and produced activity based travel data representing travel patterns for all modes in the 13-county Atlanta region.^{iv} Table 2 shows the distance based probabilities for walking and biking to each trip attractor type.

Table 10: Probability of Walking and Biking by Land Use and Distance

Trip Attractor Type	Mode	Miles from Attractor			
		0.5	1.0	1.5	2.0
Parks/Recreation	Walking	.62	.36	.21	.12
	Biking	.28	.23	.20	.17
School	Walking	.69	.34	.17	.08
	Biking	.36	.29	.23	.18
Employment	Walking	.71	.32	.15	.06
	Biking	.28	.24	.20	.17
Shopping	Walking	.72	.32	.14	.06
	Biking	.29	.25	.21	.17

Using a GIS, buffers in 0.5 mile increments up to 1.5 miles were created around each attractor. Next, the buffers were overlaid on to the road system. Each road in the system was divided into segments, which are individual segments of road between intersections. For each segment a sum of each type of attractor that is within 0.5 mile, 1 mile, and 1.5 miles was calculated. These sums were input into the LDS equation (Figure 1), along with the trip probabilities (Table 2) to calculate a score for each road segment. Then the road segment LDS were compiled into separate study area maps for bicycle and pedestrian latent demand.

^{iv} A complete overview of the SMARTRAQ project can be found at <http://www.act-trans.ubc.ca/smartraq/pages/>.

5.4 Forecasting Results

The following maps show the potential demand for bicycle and pedestrian facilities for each segment in the transportation network surrounding the Eastside Trail (Figure 59, Figure 60). In both maps, the darker green segments have the highest potential demand and the red has the lowest potential demand. These maps also show the locations of the attractors that were identified as major destinations in the study area. It is important to note that the LDS analysis indicates relative demand by road segment.

There are several important caveats to the LDS analysis. First, this analysis measures demand under existing conditions. Therefore, the creation of new attractors (such as the Eastside Trail) can increase demand in particular areas. Second, the scores present relative demand for bicycle and pedestrian facilities. Therefore, all segments in the analysis have at least some demand for non-motorized facilities, but those segments in red simply indicate lesser demand and may require less intensive facilities (e.g. “share the road” signs instead of bike lanes, narrower sidewalks or sidewalks on only one side of the street).

Atlanta BeltLine Eastside Trail

Bicycle Latent Demand Score

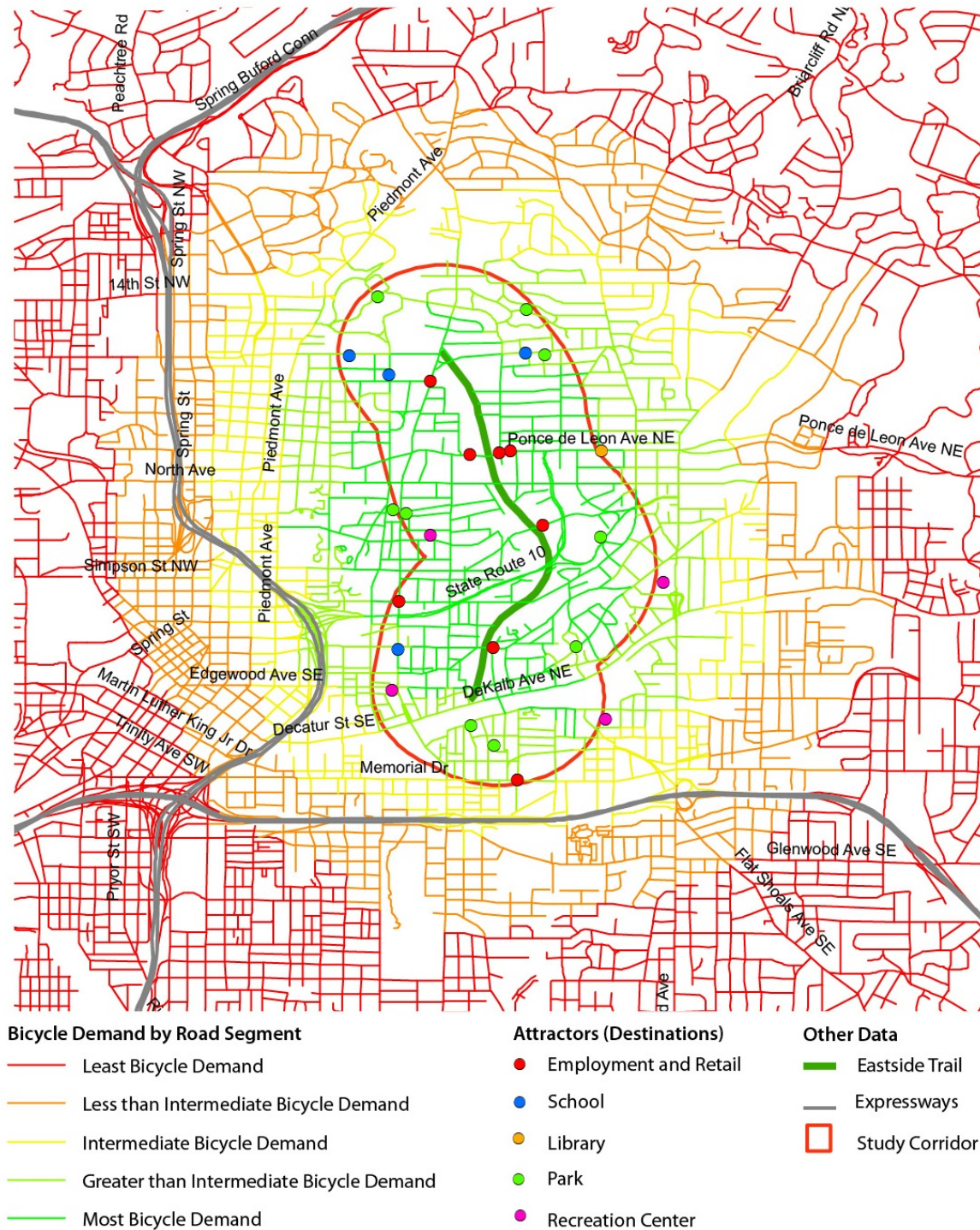


Figure 59: Results of bicycle LDS analysis.

Atlanta BeltLine Eastside Trail

Pedestrian Latent Demand Score

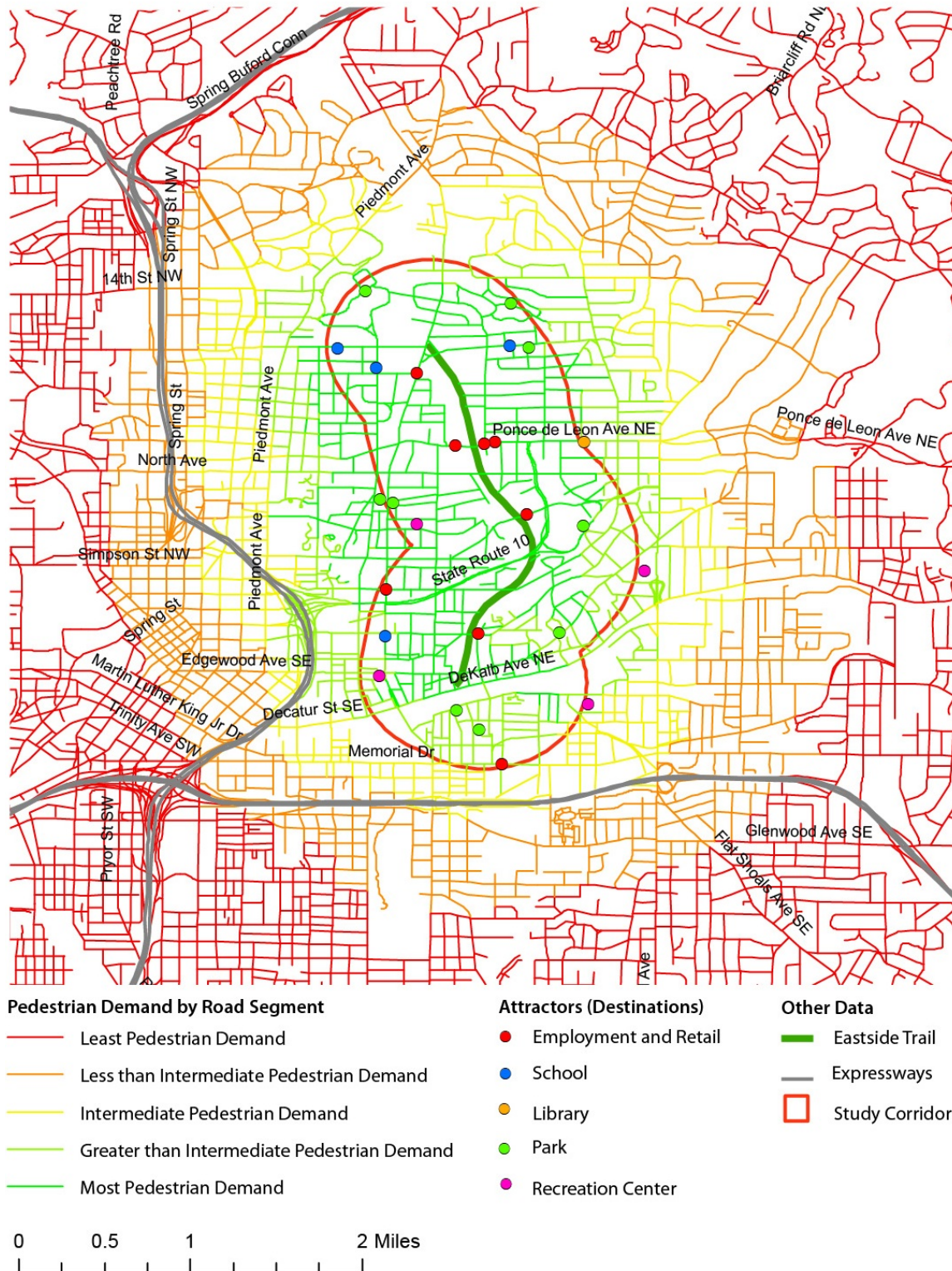


Figure 60: Results of pedestrian LDS analysis.

6. Conclusion

6.1 Recommendations

The literature states that safety and public perception of a situation as unsafe is a major deterrent to physical activity, therefore trail safety and perception of safety by the public is necessary to achieve the maximum potential health benefits of the trail.

The existence of vulnerable populations in the study area represents both a challenge and an opportunity. These groups typically suffer higher rates of negative health impacts, yet are least likely to be aware of the existence of the trail or the potential health benefits of trail usage. Therefore, since these populations have been clearly identified through this research (census tracts 17, 31, and 119), an outreach effort should be specifically targeted to reach these individuals. The public needs knowledge of the existence of the trail, particularly vulnerable populations. The large variation in socio-economic conditions of the residents along the trail coupled with targeted outreach for vulnerable populations would assist these groups with highest risk, that are least likely to be aware of trail, to utilize the trail in an equitable manner. Programs to engage these individuals could include educational efforts such as a bike safety course or general education on the benefits of physical activity through trail usage.

Certain design elements have been shown to greatly increase trail use. These elements shown to encourage trail use include: bike racks, clear and consistent signage, and bike rental opportunities. Conversely, steep slopes and poor access decrease trail usage. Implementing a general educational program advertising the health benefits of trail usage, particularly highlighting aspects less commonly known, such as positive mental health, and the health benefits associated with spending time viewing nature, is recommended.

6.2 Final Research Objectives and Conclusions

The objective of this research was to record and document the existing activity level of the population in terms of trail use including walking and cycling in the study area along the temporary Eastside Trail and surrounding study area. A secondary object was to gather current socio-demographic data for the study area population. This data will be used for future studies to

monitor the use and physical activity changes in the corridor that occur as a result of the construction of the trail.

Social capital and mental health are another important aspect of overall health. The addition of parks and greenspace to the area will increase social capital. Since the population surrounding the trail is diverse, the trail will provide an opportunity for different types of people to interact with each other, also enhancing social capital. Finally, the trail will increase the number of casual chance interactions with others which contributes to positive mental health.

Research demonstrates that many chronic diseases can be prevented or controlled by increasing physical activity levels. Physical activity promotion has become an important part of the discussion on health and the built environment. Therefore, policies, programs, and projects, such as the Eastside Trail, that promote active modes of travel and daily physical activity through walking and cycling, could potentially help to prevent or reduce the occurrence of certain diseases. Active transportation is a pathway to increased physical activity levels and is an added protection against a variety of chronic diseases. The Eastside Trail will promote methods of activity which are the most common and accessible means of incorporating physical activity into daily life.

However, persistent population differences in the outcomes and efficacy of policy interventions to promote physical activity demonstrate necessity to consider the diverging needs of various populations in any policy intervention and communication of interventions applied to the urban form. More research is needed to further examine the dynamics between built environment features, transportation and health promotion, especially given the methodological challenges underlying this type of research. However, the evidence is sufficient to begin consideration of policy interventions in order to promote behaviors such as active transportation to achieve desired positive health outcomes. The Eastside trail will provide opportunity to study the effectiveness of policy and project interventions.

7. References

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